DOCUMENT RESUME

ED 376 345 CE 067 646

AUTHOR	Smith, Catherine DeLong
TITLE	Math Literacy. Final Report. Student and Teacher Guides.
INSTITUTION	Center for Literacy, Inc., Philadelphia, PA.
SPONS AGENCY	Pennsylvania State Dept. of Education, Harrisburg. Bureau of Adult Basic and Literacy Education.
PUB DATE	94
CONTRACT	98-4020
NOTE	392p.
PUB TYPE	Reports - Descriptive (141) -- Guides - Classroom Use - Instructional Materials (For Learner) (051) -- Guides - Classroom Use - Teaching Guides (For Teacher) (052)
EDRS PRICE	MF01/PC16 Plus Postage.
DESCRIPTORS	Adult Basic Education; *Adult Literacy; Behavioral Objectives; Calculators; *Curriculum Development; Educational Games; Estimation (Mathematics); Graphs; Learning Activities; Lesson Plans; *Literacy Education; *Mathematics Skills; Measurement; Number Concepts; Numbers; *Numeracy; *Program Effectiveness; Skill Development
IDENTIFIERS	353 Project

ABSTRACT

This package contains student and teacher handbooks and a report summarizing a project during which the handbooks were developed as part of a numeracy education course for adult basic and literacy education students. Discussed in the project report are the following: development of the course's 7 numeracy education units, field testing of the units with 8 teachers and 110 students, subsequent revision of the units, and production of a math literacy curriculum and companion student and educator handbooks. Included in the student handbook are a 22-item bibliography, brief discussion of the curriculum's purpose and scope, and instructional units containing background information and learning activities on the following topics: reading, writing, and thinking about numbers; looking at numbers; estimating and rounding numbers; using calculators; measurement and its uses; retelling stories through graphs and charts; and math games. Contents of the teacher's guide are as follows: an introduction explaining the math literacy curriculum's objectives and structure, a 22-item bibliography, and seven instructional unit. Each unit includes the activities contained in the student handbook and a lesson plan detailing the lesson's goals, materials needed, and procedures for presenting individual and group learning activities. (MN)

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ED 376 345

Final Report

Math Literacy

Catherine DeLong Smith

Project # 98-4020
Federal Funding $23,798

Fiscal Year 1994

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636 South 48th Street
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The activity that is the subject of this report was supported in part by the U.S. Department of Education. However, the opinions expressed herein do not necessarily reflect the position or policy of the U.S. Department of Education or the Pennsylvania Department of Education, and no official endorsement should be inferred.

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ABSTRACT PAGE

Title: Math Literacy

Project No.: # 98-4020 Funding: $23,798

Project Director: Catherine DeLong Smith Phone No. (215) 474-1235

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Purpose: The purpose of this project was to develop, field test, and compile instructional materials on seven topics for use in numeracy education with ABLE students. The curriculum would support instruction aimed at increasing students' understanding of math and their ability to use math in their everyday lives.

Procedures: Through the Math Literacy Project, CFL developed a curriculum to increase the numeracy of ABLE students. The curriculum consists of a seven unit learners' handbook and an instructor's guide to accompany it. Materials were field tested by 8 teachers in a total of 8 classes with 110 students. Instruction using the materials was evaluated by students, instructors, and supervisors. Materials were revised as needed.

Summary of Findings: The materials were effective in supporting instruction on the topics identified. They supported math instruction which increased students' understanding of math, their interest in the subject, and their ability to use math in their everyday lives.

Comments: Objectives of the project were met and exceeded.

Products: The Math Literacy curriculum consists of a seven unit learners' workbook and an educators' handbook to accompany it on the following topics: Reading, Writing, and Thinking about Math; Looking at Numbers; Estimating and Rounding Numbers; Using a Calculator; Measurement and Its Uses; Retelling the Story: Graphs and Charts; and Math Games. The students' handbook contains an introduction and instructional materials. The teacher's guide has an introduction, detailed lesson plans, and copies of the student materials.

Descriptors

INTRODUCTION

PURPOSE

The Math Literacy project was designed to increase the numeracy skills of adult basic and literacy education (ABLE) students, helping them develop math concepts and thinking skills and encouraging them to explore and manipulate numbers. To achieve this goal, a Math Literacy curriculum was designed. The curriculum consists of a seven unit learners' workbook and an educators' handbook. The materials were field tested with eight classes, by eight instructors, and 110 students. They incorporate games, projects, and simulations. They require application of skills to everyday situations and integrating reading, writing and critical thinking. Explanations of concepts are provided as needed.

TIME FRAME

This was a twelve month project, July 1993 through June 1994.

STAFF AND KEY PERSONNEL

The project director was Catherine DeLong Smith. Other CFL educators who contributed to the project through developing and field testing materials included Elizabeth Dougherty, Faith Green, Sandy Harrill, Wendy Lovell, Jane McGovern, Anita Pomerance, Yvette Walls, and Monty Wilson. Rose Brandt, director of educational planning; and JoAnn Weinberger, executive director provided planning, supervisory, and editorial support. Gretchen McCann assisted with editing and formatting materials. Iddo Gal of National Center of Adult Literacy reviewed materials.

AUDIENCE

The immediate audience was adult basic and literacy education (ABLE) students in eight CFL family literacy and community classes. The materials were also intended for use with ABLE students in other CFL programs and programs statewide.

Permanent copies of this report and the final products will be on file for the next five years with AdvancE, 333 Market Street, Harisburg, PA and the Western Pennsylvania Adult Resource Center, 5347 William Flynn Highway, Gibsonia, PA. Copies of the materials will be provided to the nine Regional Staff Development Centers.

BODY OF REPORT

Statement of the Problem

Efforts to address the problem of illiteracy among adults in the U. S. have focused mainly on their limitations in reading and writing. More recently, there has been a growing awareness of the extent of innumeracy in this country even among highly educated adults. While ABLE programs usually include math in their curricula, the state of current instruction in math is problematic for several reasons. As a result of the extent of innumeracy in this country, it is common to find educators who are not at ease teaching math. Those who do incorporate math in adult education often follow the model used in their own elementary education. In addition, when adult learners set the goals for their instructional program, their choices, reflecting the values of the larger society, often do not include math. Those learners who do request math instruction usually do so in order to prepare for the GED test and their interest in math seldom goes beyond what the test requires.

Math literacy, like reading and writing literacy, is more than a set of skills. It involves being able to use and interpret numbers to meet one's personal goals and to function in society. In today's world, the need for skills in performing basic operations has become less important due to the availability of calculators and computers. On the other hand, there is an increased need for individuals to understand numbers and operations and to be able to manipulate them if they are to be active citizens, responsible parents, or productive workers who can make sense of their world.

The Math Literacy curriculum was designed to meet the numeracy needs of ABLE learners by helping them develop math concepts and thinking skills, e.g., a concept of the nature of numbers, skills of estimating and of identifying appropriate operations in word problems. It provides the ground work for students to continue to grow in their understanding of math through formal study or simply through approaching numbers with a new frame of mind.

The immediate audience for this Math Literacy Project was 110 learners in CFL's program. The curriculum will benefit ABLE learners statewide who are interested in improving their numeracy skills.

Goals and Objectives

Specific objectives were to:

1. develop 7 instructional materials for use in numeracy education with ABLE students;
2. develop an educators' handbook to accompany instructional materials;
3. field test materials in 2 classes with 2 teachers and 30 learners;
4. revise instructional materials based on field test;
5. produce the Math Literacy curriculum: a math literacy handbook for learners and a companion educators' guide.

Procedures

Through the Math Literacy Project, CFL developed a curriculum to increase the numeracy of ABLE students. The curriculum consists of a seven unit learners' workbook and an educators' handbook to accompany it.

The project director worked with CFL educators to develop instructional materials on seven numeracy topics, field test and evaluate the materials, and revise them as needed. The project director developed educators' materials to accompany the instructional units. Educators field tested and evaluated the materials including the usability of the instructional materials and the clarity of the educators' handbook. Again, revisions were made as needed. When all topics were completed, the Math Literacy curriculum was compiled.

Objective 1: develop 7 instructional chapters for use in numeracy education with ABLE students.

Seven instructional topics were identified based on the needs of learners and educators. Instructional materials were developed for use with students. These materials include activities for developing math skills in each topic area. The focus of the materials is the development of math understanding. They attempt to have learners see and use math differently. Connections are made between reading, writing, and thinking and math. Activities were designed to provide learners with experiences with numbers. The notions that math could be fun and did not have to be done alone were stressed and applied.

Objective 2: develop educators' handbook to accompany instructional materials.

An educators' handbook containing an introduction, detailed lesson plans, and copies of the student materials was developed. The introduction, "To the Teacher" explains math literacy, provides an overview of the materials and discusses use of calculators and computers and the role of math teams and partners in math instruction. The lesson plans offer a step by step process which even "math shy" or new instructors can follow. The student materials are included for the convenience of the teacher. Although the lesson plans are very concrete, they are intended to be used as a starting point from which the educator may deviate, as necessary.

Objective 3: field test materials in 2 classes with 2 teachers and 30 learners.

The materials were field tested in 8 classes by 8 teachers with 110 students. Some classes used all of the materials. Others selected units based on their skills and interests. All curriculum components were field tested in a minimum of 2 classes by 2 teachers with 30 students as proposed.

Objective 4: revise instructional materials based on field test.

Feedback from learners and instructors was used to revise materials. No major changes were needed in the content. Some revisions were made were for the purpose of providing clarity of directions or procedures. For example, students suggested the rules for handling dice in the games section. Rounding numbers was understood better by the members of one class through one procedure and by members of another class through a different one. Both approaches are included in the curriculum. Other revisions affected the order of presentation of materials. For example, it was found to be more effective to have students create graphs from information in their daily lives before beginning to interpret existing graphs. In a few cases, feedback led to the inclusion of new materials such as the percent function on the calculator and converting measurements.

Objective 5: produce the Math Literacy curriculum: a Math Literacy handbook for learners and a companion educators' handbook.

The Math Literacy curriculum was produced. It consists of seven chapters and accompanying instructor's manuals covering the following topics:

- Reading, Writing, and Thinking about Numbers discusses the role of reading, writing, and thinking in math instruction. It encourages students to work together as teams or partners. Students are encouraged to write a math journal as a record of their learning experiences and for the purpose of self-assessment.
- Looking at Numbers introduces concepts of whole numbers, place value, zeros in place value, reading and writing large numbers, ordering numbers, and reading number sentences.
- Estimating and Rounding Numbers offers information and practice with estimating and rounding numbers. This chapter focuses on estimation as one of the most useful tools in math learning.
- Using a Calculator offers an introduction to calculator use with step by step instructions for operations in addition,

subtraction, multiplication, division, and percents. Using a calculator frees learners to better explore math concepts and theory rather than staying with the drudgery of computation.

- Measurement and Its Uses focuses on the English system of measurement. Beginning with the history of standardized measurement, this chapter aids students in converting measurements of length, weight, and liquid.
- Retelling the Story: Graphs and Charts introduces a variety of graphs–pictograph, circle graph, bar graph and line graph. It covers both creating and interpreting graphs and charts.
- Math Games includes eight games. These games demonstrate that learning math is fun.

In addition to the student materials, the instructors' materials include an introduction that provides an overview of math literacy and the Math Literacy curriculum and detailed lesson plans.

OBJECTIVES MET

Objective 1: develop 7 instructional chapters for use in numeracy education with ABLE students.

Instructional materials were developed on seven topics to increase the numeracy skills of students in ABLE programs.

Objective 2: develop an educators' handbook to accompany instructional materials.

An educator' handbook including an introduction, detailed lesson plans, and a copy of the student materials was developed.

Objective 3: field test materials in 2 classes with 2 teachers and 30 learners.

The materials were field tested in 8 classes by 8 teachers with 110 students.

Objective 4: revise instructional materials based on field test.

Materials were revised to address needs identified.

Objective 5: produce the Math Literacy curriculum: a Math Literacy handbook for learners and a companion educators' handbook.

The Math Literacy curriculum, a 163 page student manual and a 203 page educators' handbook were completed.

OBJECTIVES NOT MET

All objectives of the project were met or exceeded.

EVALUATION

As stated above, all objectives of the project were met or exceeded. Students who participated in the project evaluated the materials and assessed their math literacy skills pre- and post-instruction. They felt that the curriculum had given them a new view of math, helped them to develop new math skills, and helped them to increase the basic math skills they brought to the program. Instructors also felt that the materials were useful for math literacy instruction. Iddo Gal of the National Center on Adult Literacy reviewed the materials and felt that they address many of the needs in numeracy education and support the development of math literacy skills in adult students.

DISTRIBUTION

Permanent copies of this report and the final products will be on file for the next five years with AdvancE, 333 Market Street, Harisburg, PA and the Western Pennsylvania Adult Resource Center, 5347 William Flynn Highway, Gibsonia, PA. Copies of the materials will be provided to the nine Regional Staff Development Centers.

CONCLUSION

The need for the development of math literacy skills in adult education is now receiving the attention which other aspects of adult literacy instruction have received for some time. The types of instruction that adults received in school are being replaced by approaches which help adults to see math as a way of thinking, support understanding of math concepts over the development of computational skills, encourage adults to explore math in the world around them, and focus on math skills needed in today's world.

The Math Literacy curriculum supports math instruction in which students are active participants working together as partners or teams, exploring math ideas, and applying math to their lives. It encourages students to see math as a way of thinking and of viewing the world and helps them to see that math can be interesting and fun.

Math Literacy

Section 353, Project #098-4020

by

Catherine DeLong Smith
Curriculum Developer

July 1994

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JoAnn Weinberger, Executive Director

The activity that is the subject of this report was supported in part by the U.S. Department of Education. However, the opinions expressed herein do not necessarily reflect the position or policy of the U.S. Department of Education or the Pennsylvania Department of Education, and no official endorsement should be inferred.

Math Literacy

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Acknowledgments

I am grateful to the following teachers and their students, at the Center for Literacy, for discussing teaching practices and learning styles; piloting materials and offering suggestions for revisions; and supporting the project's year-long development. Their voices and encouragement guided me in writing these materials:

Elizabeth Dougherty, instructor, Parent Child Center class;
Faith Green, instructor, Hill School Even Start class;
Sandy Harrill, instructor, West Philadelphia community class;
Wendy Lovell, instructor, Pastorius School Even Start class;
Jane McGovern, instructor, Broad and Morris community class;
Anita Pomerance, instructor, Stearne School Head Start class; and
Monty Wilson, instructor, Douglass School Even Start class.

Special thanks to the Healthy Start class, Kingsessing Library, for field testing the materials for each chapter and for telling their teacher that they "love math."

Additional thanks to Rose Brandt, CFL's Director of Educational Planning, for her help in editing and shaping this manual and Yvette Walls, CFL educator, who read several drafts.

I am also indebted to Iddo Gal of the National Center on Adult Literacy (NCAL) for his review of this material and for his insightful discussions of teaching practices of numeracy. Special thanks to Lynda Ginsburg of NCAL for her generous encouragement and support. I would also like to thank the Inquiry Group on Adult Numeracy (sponsored by NCAL and the University of Pennsylvania and led by Iddo Gal and Lynda Ginzberg) of which I was gratefully a member: Richard Drucker, Community Occupational Readiness and Placement Program; Frederick Leinhauser, Adult Education, Temple University; Lynne Mikuliak, Community Women's Educational Project; and Christa Snow, Nationalities Service Center.

I would also like to thank Shelley Bourgeois, Catherine Coleman, Martha Merson, and Mary Jane Schmidt of the Massachusetts ABE Math Standards Inquiry Project for their interest and ideas.

Ben Burenstein of Drexel University's Office of Computer Services deserves special thanks for sharing his computer expertise.

The development of these materials was supported in part by the U.S. Department of Education and the Pennsylvania Department of Education, Division of Adult Basic and Literacy Education Programs.

To the Student

Math literacy, like reading and writing literacy, is more than a set of skills. It involves being able to use and interpret numbers in the real world of adult math and to meet your personal goals.

The availability of calculators and computers in today's world makes the need for skills in performing basic operations less important. There is an increased need for individuals to understand operations and relationships of numbers and be able to manipulate them with ease. This understanding enhances math students' abilities to be active citizens, supportive parents, and successful employees as they make sense of their world.

Hopefully, *Math Literacy* will lay the ground work for you to begin thinking about the world mathematically, viewing math differently, and developing a math sense which will continue to grow as you pursue an understanding of math through formal study or simply through approaching numbers from a new and different viewpoint.

Math Literacy was written to address some of the needs in the field of adult literacy and numeracy. It offers you an introduction to math that will provide a foundation for further study of mathematics. It also provides practice with reading, writing, critical thinking, and discussion of math.

The materials are designed to provide you time for reflection and discussion of materials; activities for math teams and math partners;

individual and group writing; game playing and of course, practice focusing on understanding different aspects of numeracy. The materials emphasize the need for using math to communicate through reading and writing as it attempts to integrate those skills with math.

- You should feel free to use the range of tools at your disposal, particularly calculators, estimation, mental math, and working with other class members.
- In every chapter, activities are provided that can be used by class members as teams or partners. Group interaction helps math learners identify their particular learning styles. Working in math teams or as math partners has been proven to be a very effective learning tool and often helps those who are involved in peer-teaching to develop a better understanding of the material as they work with a fellow math teammate or math partner.
- Each chapter in *Math Literacy* allows you time in class to write about math in several different ways. Using a math journal is one way that you can use your writing skills. Writing word problems, mystery and other stories, or writing your own lesson plans are other ways to include writing and reading in your math learning. Math can be read in many places in your everyday life from reading the newspaper, bus schedules, or television guides to grocery shopping and reading nutrition labels.

Math Literacy is divided into seven chapters. Each chapter begins with a few questions to help you determine what you know about the

Reading, Writing, and Thinking About Math

- What Do You Know?
- Math Partners and Teams
- Writing a Math Journal
- Math and the Newspaper

Reading, Writing, and Thinking About Math

What Do You Know?

Answer the questions below. They will give you an idea of what you think about learning math. Discuss and share your ideas with your class members. Use other paper if you need more room.

1. What could be some of the advantages of working in math class with a math partner or on a math team? ____________________

2. What do you like best about learning math? ____________________

3. What seems to be the hardest thing for you in math? ____________________

4. Was the same thing hard for you when you were younger? ____________
   Can you explain?____________________

5. If you could change one thing about learning math, what would it be?___

6. What would you like to learn now, and how would you like to learn it?
   ____

Math Partners and Teams

Someone once told a story about visiting a math class. The class was very quiet as they worked on math. On the board were a list of rules for the class. All of the rules were strict, but one stood out for the visitor: "Work alone – do not speak to your neighbor!"

How often did we hear these words when we were studying math in school? The rule requiring us to work quietly and alone kept us separated from everyone in the classroom as we learned math.

Why Work Together?

Working as part of a team or with a math partner helps prepare us for the math that we do as adults. When we do math in our every day lives, we often work with other people.

Working together in the classroom can change the atmosphere to one of cooperation and generate lively discussion. Working together also reinforces the math knowledge we already have and gives us a chance to teach others what we know. Sometimes others can help us by bringing a different viewpoint to a math problem.

Working in a group or with a partner can help us build self-confidence and leadership skills. It can also help us to improve the way we communicate with each other and to realize that teaching someone else is the best way to learn.

Working together is not only important, it is also fun and makes the challenges of math less frustrating.

Activity: Building Math Teams or Working with a Math Partner

Discuss different math activities and talk about which ones would be better done in groups or in pairs rather than alone. Activities such as creating a graph or playing a multiplication game are sometimes better done in teams. Learning to use a calculator or working on a specific percent problem may be better done with a math partner.

Which class activities would you like to do working in a team?

1.____

2.____

3.____

4.____

Which activities would you like to work on with a math partner?

1.____

2.____

3.____

4.____

Working as Math Partners: Math Interview

Agree to be a math partner with someone in your class. Then interview each other about your thoughts and feelings about math and your math learning history.

Questions can include:

- How did you feel about math when you were in school?
- How do you feel about math now?
- Do you work with your children on their math?
- Do you find yourself using math in your daily life, and if so, what kinds of things do you have to do?
- What is your goal for yourself in this math class?
- Is there anything you would like to do differently in class or in math?

Working as Math Teams: The Bagel Game[1]

To play the Bagel Game, the class divides into two teams. Each team should decide on a team name to describe themselves. The teams should go over the rules of the Bagel Game carefully so that each team member knows what to do.

The Bagel Game is played at the blackboard. The board is divided in half. Each half has a bagel shape drawn in the middle of it. (See bagel on next page.) Each bagel is divided into eight sections by spokes which continue outside of the bagel. A number is placed in the hole of the bagel. Other numbers are placed in the eight sections of the bagel.

---

[1] DeLong Smith, Catherine. *Exploring Culture: We are Math Learners.* Philadelphia, PA: Center for Literacy, Inc. 1993.

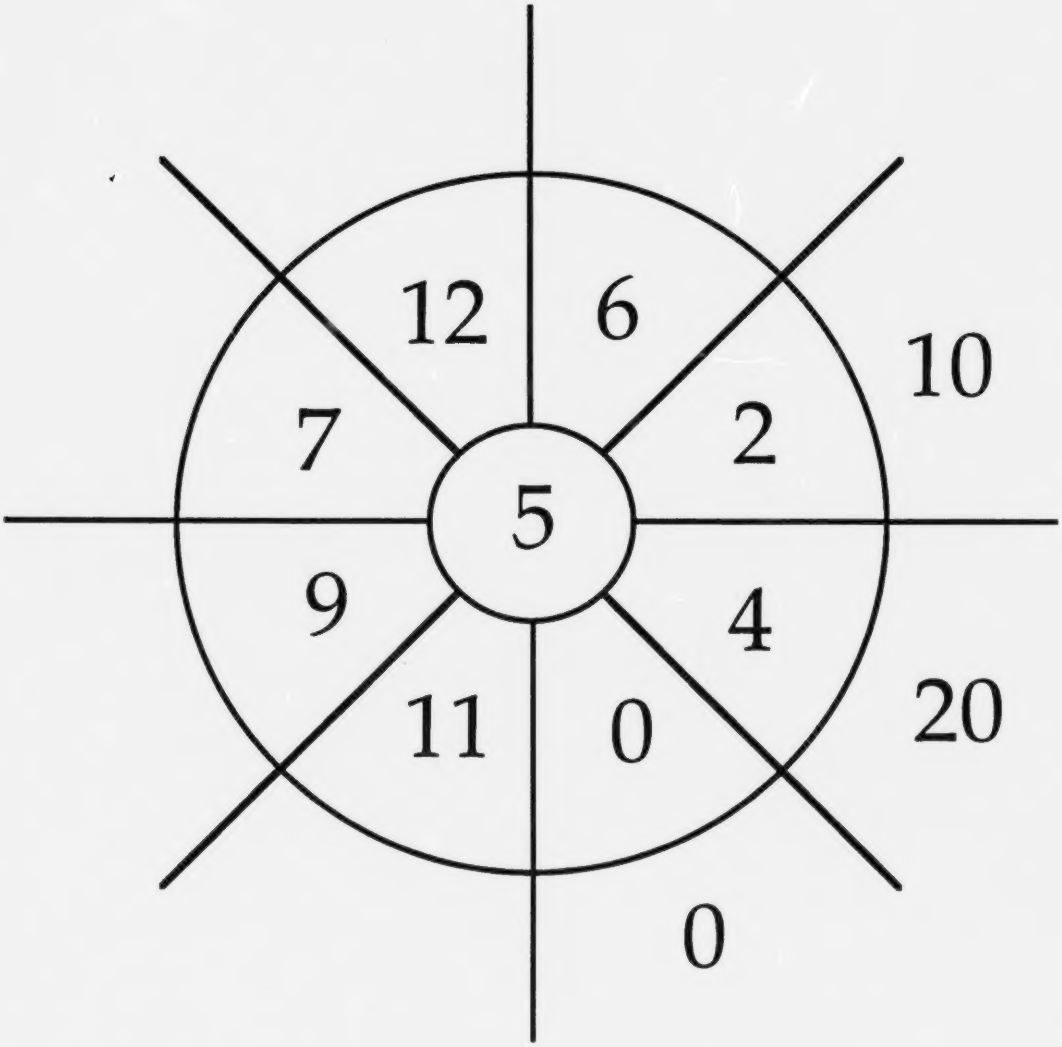
Object: **Each of the numbers in the eight sections of the bagel is multiplied by, divided by, added to, or subtracted from the number in the hole of the bagel.**

Members of each team take turns going to the blackboard. They challenge their math skills by either multiplying, dividing, adding, or subtracting the bagel numbers. Their answers are placed in the spaces outside of the bagel.

When a team member completes all the bagel problems, he or she calls out, "Done!" The opposing team then checks the first team's answers. If all the answers are correct, the point goes to the first team. If there are any incorrect answers, the point goes to the opposing team.

Bagel Game

Here is an example of the Bagel Game using multiplication.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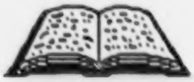
Writing a Math Journal



What Is a Journal?

Have you ever written in a journal? Many people find it helpful to keep a journal as they learn new things. They use the journal to write about their feelings or to describe events. You can use a journal to record what you learn in math and your impressions or concerns.

A journal can be written in a spiral notebook or a bound manuscript book or on any kind of paper that is on hand. Some people write their journals on a computer. The important thing is to write your journal in a way that keeps your ideas together.

Where you record your journal is not as important as what you write, for yourself or to others.

Don't worry about the mechanics of writing when writing in your journal. Keeping a journal is not about spelling or punctuation or sentence fragments. Instead, let your feelings and ideas flow from your brain to your hand. For example, don't worry about spelling the word "calculator" correctly!

A journal can be a completely **private** activity, one that isn't shared with others. A journal can also be a **dialogue** between two or more people.

Dialogue Journal

A **dialogue journal** is a conversation that is written instead of spoken. It is a journal that is passed back and forth between you and your teacher or between you and your math partner or team. You can also use a dialogue journal to ask and answer questions. For example, in her math dialogue journal Pat wrote:

January 17
"Anyone on my math team can answer this - what happens when I change $^1/_3$ to a decimal? Does it keep repeating or am I getting something wrong?"

A member of her team who responded that week to Pat's journal wrote back:

January 20
"That's one of those repeating decimals. Just quit after the hundredths place. You'll be fine."

When you read other people's dialogue journals, don't criticize their writing. Remember, you are exchanging ideas. You and your dialogue journal partner need the freedom to express your ideas however you wish.

If you decide to keep a dialogue journal, there are some things to think about:

- **Who are you going to "dialogue" with?**

  You may enjoy writing a dialogue journal with your math teacher. The dialogue journal will allow you to communicate your feelings about any problems you are having in math. It will also give you and your teacher an opportunity to think about the class.

  A dialogue journal also gives you a time to ask yourself questions: Are you learning at the speed that is comfortable for you? Do you need special help with anything—for example, decimals or fractions?

- **How often are you going to write and respond?**

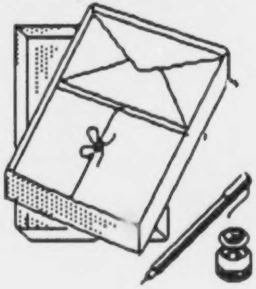
  When you first start keeping a dialogue journal, "talking" to someone in writing may be so exciting that you exchange journals with your team or partner fairly often. As time goes on, you or your dialogue partner may not want to spend as much time on this activity. This reaction is common.

  In deciding how often to write and respond, communicate with your dialogue partner or team. Discuss how long it will take you to read, think, and respond in writing to another person.

- **Discuss ideas about journal sharing.**

  Discuss your ideas about sharing your journal with your partner. Perhaps you and your partner can set up rules for journal sharing. Even though you may share your thoughts with the partner you selected, you may not want a stranger or others in class to know about your feelings regarding math or a particular math lesson. You can agree with your partner on how you want to share your journal. You may want to talk about how trust allows you to be comfortable in your writing and that in order to be able to share with your partner, you need to trust each other.

Remember, in dialogue journal writing you do not correct someone else's writing, and you don't expect yours to be corrected unless you ask for it.



When Do I Write In My Math Journal?

The best time to write in your journal may be at the end of class, while your thoughts are still fresh. However, any time is good as long as you feel like writing.

Sometimes it is helpful to record a certain event. For example in her math journal, Melissa wrote:

> **March 10**
>
> **"Today I won the bagel game for my math team. Everyone was amazed at how I had the multiplication tables down cold. They asked me how I learned them so well. It felt great to give advice. I told them that I learned fast helping my kids. Thursday I'm going to work with Vanessa and show her how I did it."**

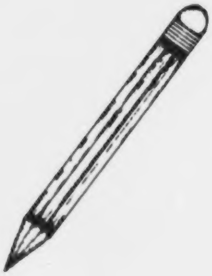
Remember to write the date each time you write in your journal. Later you will be able to go " backwards in time" and read what your thoughts and feelings were many months before. You will probably be surprised at how much you have learned and how your attitudes about math have changed.

Tara wrote in her journal in December:

> **December 8**
>
> **"I hate these percentages. I'll never understand this stuff. Who cares?"**

In February, she reread her entry, laughed and wrote the following:

> **February 6**
>
> **"Now percentages make sense. I guess I'll keep writing but sometimes I feel like I don't want to move to something new."**



Getting Started as a Math Journal Writer

Here are three questions that might help you get started writing about math:[2]

1. **What stuck with you?**

   Was there anything during class that made you excited or interested? Anything that made you want to shout, "I love math!"

2. **What didn't you understand about today's lesson?**

   Did you need more examples or more time for anything? Was the class going too fast? Did you feel left behind? Was it too slow?

3. **Did you learn anything new today?**

   Or did you remember something that you had forgotten? Was there anything that you can take home and use or share with other family members, children, or friends?

---

[2] Curry, D. *Mathematics as Communication: Journey into Journal Jottings. Implementing the Massachusetts Adult Basic Education Math Standards.* Marden, MA: The Massachusetts Department of Education ABE Math Team. 1994.

Exercise:

Take 15 minutes and write about math and you. Use the space below or write in your own journal if you have started one.

Math and the Newspaper

Reading the newspaper can be an interesting way to work toward learning goals. Newspapers provide many different types of information. Some of this information includes numbers and math ideas, such as percents. We call this "numerical information."

Try this:

- **Divide up** a newspaper between math teams or partners.

  Look through a section and make a list of the kinds of numerical information (numbers and math ideas) you find. Don't forget that page indexes and weather temperatures are examples of numerical information. Use more paper if you need to.

1.______________________________ 6.______________________________

2.______________________________ 7.______________________________

3.______________________________ 8.______________________________

4.______________________________ 9.______________________________

5.______________________________ 10.______________________________

Advertisements in Newspapers

Read the newspaper ad below and underline anything that provides numerical information:

EVERY SPORT COAT

ARMANI • EAGLE • BOTANY '500'

59^{95} to 99^{95} NONE HIGHER!

COMPARABLE VALUES $250 TO $275

100% silk, 100% wool. Sizes to 60.

MON. to SAT. 10 to 9:30 SUN. 11 to 6

Let's take a look at the information provided in the ad.

"Every sport coat" tells us that the ad refers to all sport coats in the store. Some ads use words such as "selected merchandise" to tell us that not every item is on sale.

"$59.95 to $99.95 - None Higher" The key word in this price information is **to**. The advertiser is telling us that the coats will be sold at prices **between** $59.95 **and** $99.95. They could be $79.95 or $89.95 or any other amount that is between the two prices in the ad. "None higher" means that no sport coat will cost more than $99.95.

"Comparable" is another key word that gives us information. It tells us that we are getting a bargain because the sport coats have a value of $250 to $275.

"100% silks, 100% wool" tells us that the coats are made of all silk or all wool material. When something is 100%, it is all of something or the whole thing.

"Sizes to 60" tells customer what sizes are available. Since most people wear a size between 40 and 46, the ad lets the reader know that extra-large sizes are available.

"MON. to SAT. 10 to 9:30 SUN. 11 to 6" Are you familiar with time and date information? Work with your math partner to answer the following questions:

1. How many days of the week is the store open?______________________
2. How late is the store open on Tuesday night?______________________
3. When does the store open on Saturday morning?____________________
4. Is the store open the same number of hours on Sunday as it is on Friday?___

Activity: Look for other newspaper advertisements that give you similar numerical information. Take turns with your math partner in making up and answering questions about the numerical information in the paper.

Reading Ads in the Travel Section of the Newspaper:

Ads in the travel section of the newspaper provide many different kinds of information. Read the advertisement below for a trip to Bermuda.

Fly Away Airways
Vacation Bermuda Break

BERMUDA

from **$419**

SELECT GUEST COTTAGES

3 days/2 nights
$45 of taxes included in price

All 3-7 day packages include:

- *Round-trip air via Fly Away*
- *Sand Reef Hotel*
- *Travel period 5/23/94 - 6/15/94*
- *$449-$709 Optional meal plans available.*

Terms and Conditions: Prices are per person, double occupancy for round-trip for departures midweek from Philadelphia. Prices do not include passenger surcharges of up to $12 per person. Bermuda hotel tax of $20 and Bermuda departure tax of $15 for adults and $5 for ages 2-11.

As a class, make a list on the board of all the numerical information provided in the above travel ad. *Example:* 3–7 day packages.

The information in this travel ad is confusing. It also uses numbers in such a way that it is difficult to understand some of the terms and conditions of the vacation offer. Discuss with other class members what numerical information in the ad is unclear or confusing and then do the following activity.

Activity: Answering these questions will help to understand the ad.

1. Does the trip cost only $419? Why or why not?____________________

____

2. From information in the ad ("3 *days/2 nights*"), if I arrived on Tuesday, when would I have to leave?____________________________________

____

3. Can you tell from the ad what your total taxes on the trip will be?____

____

4. When can you take this trip?____________________________________

5. What does it mean when numbers have a dash (—) between them (for example, $449 – $709)?______________________________________

6. What does "surcharge" mean? (You will also find this term on your telephone bill.)____

7. Why do you think that some information is in smaller print than other information?____

Activity: Look for other travel ads in the newspaper and compare them to this ad. Find other examples of information in small print.

Reading Numerical Information

Sometimes ads present numerical information in the form of words and sentences. The ad below for a new health care plan tells you about free seminars (information classes) and some other benefits of the plan.

FREE SEMINARS ON A
LOWER-COST, BETTER
HEALTH CARE PLAN THAT
PROVIDES 100% COVERAGE.

- GET THE FACTS ON **YOUR WAY HEALTH PLAN WEST** -
  100% Protection for less money than traditional Medicare Supplements!
- NEW PRESCRIPTION BENEFIT -
  $5 GENERIC, $10 BRAND NAME: $500 ANNUAL LIMIT
- DOCTOR VISITS JUST $2
- NO DEDUCTIBLES

CALL TOLL FREE AT 1-800-111-2222

Activity: Underline all the numerical information in the ad. Words such as "free" or "lower-cost" relate to numbers or the numerical value of something. After you have underlined the words, discuss their meaning with other class members.

Sports Math in the Newspaper

Articles about sports use numerical information all the time to let fans know how their favorite teams and players are doing.

> "Tommy Greene, who got his **first** win of the season Thursday night, was **12-0** at Veterans Stadium since **Sept. 3, 1991**."
>
> "Pete Incaviglia has collected **five consecutive** hits, reached base **six times in a row** and has hit .455* in his **previous seven** games."

If you or your math partner are interested in sports, discuss the meaning of the information in the bold print above.

1. Which terms can be used outside of sports?____________________
   ____
2. Which terms are specific to baseball?________________________
   ____
   ____
3. What other sports are you interested in that use numerical information to let you know what is going on with the team's or a favorite player's game?________________________________
   ____

* Batting average is the percentage of base hits that a player gets. A base hit means that a player hits the ball and gets to base without getting anyone else on his team out in the process. Batting average is computed from the total number of times that a player has gone up to bat. Example: If a player bats 10 times and he gets 5 base hits, divide 5 by 10 to get a batting average of .500.

What Else is in the Newspaper or Magazines?

Newspapers and magazines provide all kinds of numerical information. You have already made a list of some of those things. **Compare** your list with the list below.

- Medical information
- Weather forecasts, temperature
- Business information
- Carpentry directions
- Sports statistics
- Cooking recipes
- TV schedules
- Advertisements

You have now become familiar with looking for numerical information as you read newspapers and magazines. Return to the beginning of this chapter and re-read What Do You Know? with your math partner. Discuss any new information that you have learned. Write about it in your math journal.

Looking At Numbers

- **What Do You Know?**
- **Whole Numbers**
- **Place Value**
- **Reading Large Numbers**
- **Odering Numbers**
- **Number Sentences**
- **Writing Whole Numbers**

Looking At Numbers

What Do You Know?

Answer the questions below. They will give you an idea of what you know about numbers. Discuss and share your ideas with your class members. Use other paper if you need more room for your answers.

1. Which number is a whole number?

   a. 3/4 b. 34 c. .34

2. Look at the numbers **127** and **217**. What is the difference in the digit **2** in these two numbers?______________________________

   ____

3. List some of the ways that place value helps you in your math:

   ____

   ____

4. What is the place value of the highlighted number 2 in the following number?**427**____The value for the number 2 is the _____ place.

5. What value does a zero have in a number?__________________

   ____

6. Articles in the newspaper often refer to large numbers. Working with your math partner, read the following paragraph and answer questions 6 a., b., and c.

The Math Times Daily

On Friday, the city-wide lottery jackpot reached $348,009. People came from nearby towns to buy a ticket. The lottery will be used to help the city raise money for after-school children's programs. 476,321 lottery tickets have already been sold for this month's lottery, with an expected total of 500,000 to be sold before the drawing the last day of the month. The city hopes to raise $1,187,455 before the end of the year

6. a. How much is the lottery jackpot?____________________

   b. How much does the city expect to raise before the end of the year?____________________

   c. Has the city sold all of this months tickets?____________

7. Write out the following numbers using words:

   a. 732 ______________________________

   b. 4,405 ______________________________

   ____

8. List the following numbers below in their size order, smallest to largest.

   a. 321 **b.** 113 **c.** 1,113 **d.** 42 **e.** 42,113 **f.** 2,011 **g.** 3,101

   1.________________ 5.________________

   2.________________ 6.________________

   3.________________ 7.________________

   4.________________ 8.________________

Whole Numbers

Look at these numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9. These are called **whole numbers.** (We also use 0 in combination with whole numbers, for example, when you count to 100.) Whole numbers are **equal** to, or **more** than, the **whole number 1**. Fractions and decimals can be less than 1. **Whole numbers** can be used to count and they can be used to represent a value.

• **in measurement**	**Her son is now 3 feet tall.**
• addresses	**Betty lives at 820 North 56th Street.**
• **to put in order**	**She was number 1 in her class.**

Think of other uses for whole numbers:

1.____________________

2.____________________

3.____________________

4.____________________

5.____________________

6.____________________

7.____________________

8.____________________

Activity: Whole Numbers

With your math partner, look around your classroom and write down anything that has a whole number on it. Look in your book bag or purse or at anything, such as a poster or map that is on the wall. Maps and posters often have whole numbers on them.

____

____

____

Whole Numbers

Look at these numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9. These are called **whole numbers.** (We also use 0 in combination with whole numbers, for example, when you count to 100.) Whole numbers are **equal** to, or **more** than, the **whole number 1**. Fractions and decimals can be less than 1. **Whole numbers** can be used to count and they can be used to represent a value.

• **in measurement**	**Her son is now 3 feet tall.**
• addresses	**Betty lives at 820 North 56th Street.**
• **to put in order**	**She was number 1 in her class.**

Think of other uses for whole numbers:

1.____________________
2.____________________
3.____________________
4.____________________
5.____________________
6.____________________
7.____________________
8.____________________

Activity: Whole Numbers

With your math partner, look around your classroom and write down anything that has a whole number on it. Look in your book bag or purse or at anything, such as a poster or map that is on the wall. Maps and posters often have whole numbers on them.

____

____

____

Zeros and Place Value

Zeros do not have any real value. If someone gave you 0 apples you would have no apples. But if someone gave you 10 apples that would be different. The zero is now a place holder. With 10 apples, the 1 is in the tens place and 0 is in the ones place. You have one ten and zero ones when you have 10 apples. In the above number, 4,378,025, the zero is in the hundreds place. There is nothing (zero) in the hundreds place, but the zero is important because it is holding a place in the number. Zeros are helpful as place holders when we are writing numbers.

Place Value

Numbers such as your age or the number of your street address are whole numbers. Individual numbers are called digits. 3 is a digit until it represents something such as a toddler's age. Once the digit has a value, it is then referred to as a number.

In the space provided, write your age_____________ and your house or building number (example: **1352** Chestnut St.)_________________

Look at your age. How many **number places** does it have?_______

How many **number places** does your house number have?______

Every digit has a **place**. The number 3 has one digit so it takes up one place. The number 33 has digits and has two places. Your age probably has two places.

Words and Numbers; Letters and Digits

Words are made up of letters. Letters alone have no meaning unless we assign them a meaning such as "Row B." When we put them together to form a word, we give letters meaning. The letters "e - t - e - r" have no meaning in our language until we use them to form the word "tree." Letters are similar to digits and numbers are similar to words. We use digits to create numbers which have value.

If you saw the number 612 scattered around a room with the digit 1 on the ceiling and 2 on the floor and 6 on the table, would you be able to read these digits and decide that the number was actually 612? Probably not.

By putting the digits in the proper place, you have assigned the digits **value.** This is called **place value**. Place value gives digits meaning.

Place value is important when you do different operations with numbers. For example, when adding or subtracting numbers, it is important to align (line them up) them by place value.

You could not correctly add a column of whole numbers if it looked like this:

```
    32
   20
 +  432
   23632
```

It should look like this:

$$\begin{array}{r l} 32 & \\ 20 & \\ \underline{+432} & \\ \mathbf{464} & \textbf{Correct.} \end{array}$$

Each of these number places has a name. The following chart will help you to learn the names of the most important whole number places.

Place Value Chart

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
4	3	7	8	0	2	5

Looking at the table above, the number that is showing is written like this: **4,378,025** and read: **four million, three hundred seventy-eight thousand, twenty five.** The 4 is in the millions place. The 3 is in the hundred thousands place. 7 is in the ________________________ place. 8 is in the thousands place. _____is in the hundreds place. 2 is in the tens place and ___ is in the ones place.

Fill in the above chart with the following numbers. Put the numbers in the correct place value in the chart.

a. 208 **b. 3,217** **c. 8,200,893** **d. 29**

If you think you need more practice, work with your math partner and, using numbers of your choice, discuss what place value the digits of the numbers hold. Example: Create a number — 349. The three is in the hundreds place, the four in the tens place, and the nine in the ones place.

Activity: Place Value

Figure out the place value of the numbers below. Work with your math partner if you have any problems with the larger numbers. Fill in the blanks. The first one is done for you.

1. 28 ___2___tens and ___8___ones.

2. 6 ________ones.

3. 41 ________tens and ________ones.

4. 17 ________tens and ________ones.

5. 120 ________hundreds, ________tens and
________ones.

6. 387 ________hundreds, ________tens and
________ones.

7. 502 ________hundreds, ________tens and
________ones.

8. 2,108 ________thousands, ________hundreds,
________ tens and ________ones.

9. 7,896 ________thousands, ________hundreds,
________ tens and ________ones.

10. 41,080 ________ten thousands, ________thousands,
________hundreds, ________tens and ________ones.

11. 68,451 ________ten thousands,________thousands,
________hundreds, ______tens and ______ones.

12. 321,831 ________hundred thousands,
________ten thousands, ________thousands,
________hundreds, ________tens and
________ones.

13. 2,023,466 ________millions,_________hundred thousands,
________ten thousands,__________thousands,
________hundreds,________tens and
________ones.

14. 8,003,502 ________millions,_________hundred thousands,
________ten thousands,__________thousands,
________ hundreds, _______tens and
________ones.

Reading Large Numbers

- **Each day, close to 400,000 persons cross Philadelphia's borders on their way to work. About 260,000 enter the city and 130,000 leave.**
- **The five-county (Bucks, Chester, Delaware, Montgomery, and Philadelphia) region's gross product (value of products made by workers in the area's five counties) is $110 billion.**
- **Hospital wages and salaries in Philadelphia county in 1990 were $3,464,000,000.***

* The above information was compiled for the Philadelphia Almanac and Citizens' Manual, 1994. Kenneth Finkel, Editor. Philadelphia, PA: The Library Company.

What did you think as you read the above information? Could you visualize **$110 billion** or **$110,000,000,000**, the gross product (value of products made by area workers) of the five counties mentioned? Reading and understanding large numbers can be difficult. Sometimes it helps if you can put the information into perspective, or in relation to something that you already know. If the President of the United States makes **$200,000** per year, it would take **550,000** years to earn **$110** billion. If you made **$25,000** per year, it would take you **4,400,000** years to earn $110 billion.

Visualizing Large Numbers

Try this: Here is one way to begin to visualize big numbers. You will need several snack size boxes of raisins. Work with your math partner or your math team.

A small snack-size box of raisins has 80 raisins in each box, a 100 raisins would be 20 more. Count out 100 raisins and look at the size of the pile. Imagine how large the pile would be for **1,000** or **10 times** the size of your original pile. A **million** raisins would be a **1,000 piles** of **100** raisins. That's a lot of raisins!

Library Research: In the library with your math partner or a member of your math team, research the national debt of the United States. Our national debt is in the trillions of dollars. Find out how big a trillion is. Is it smaller or larger than a billion?

Above, you thought about how many years it would take the president of the United States to earn $110 billion. With your math partner, try to figure out how many years it would take to pay off a national debt of 5 trillion dollars ($5,000,000,000,000) if we paid back $500,000 a year; $2,000,000 a year.

When you find the answer to the real national debt, try the same exercise. Compare with other teams in your class.

Commas in Numbers

Commas are used to help us read large numbers quickly. In larger numbers, commas separate numbers in groups of three.

In the number **214,326,352** (read two hundred fourteen million, three hundred twenty-six thousand, three hundred fifty-two) a comma separates the millions from the thousands. The thousands are separated from the ones by a comma. There is a pattern of grouping the numbers by three going right to left. Look at the following numbers and see the pattern.

324,569	Three hundred twenty-four thousand, five hundred sixty-nine.
43,897,333	Forty-three million, eight hundred ninety-seven thousand, three hundred thirty-three.
7,325,554	Seven million, three hundred twenty-five thousand, five hundred fifty-four.
232,899,543	Two hundred thirty-two million, eight hundred ninety-nine thousand, five hundred forty-three.
2,110,000	Two million, one hundred ten thousand.
75,802	Seventy-five thousand, eight hundred two.

It can help to give the commas names. When reading the number **2,110,000** think of the first comma from the right as the **thousand comma** and the second comma as the **million comma**. The number will read: 2 **million ,** 110 **thousand.** When reading a large number, read each group of digits between the commas separately.

Read the number **313, 754, 612.** Using the commas to help you "punctuate" the number, read each group of digits. The number is read: 313 **million, 754 thousand,** 612. It is written like this: **Three hundred thirteen million, seven hundred fifty-four thousand, six hundred twelve.** Remember not to add the word **and** when you are reading or writing a number.

Activity:

Insert the commas in the following numbers to show place value. Use the first number as an example.

1. **44, 389, 200**
2. 21398576
3. 1234
4. 23811008
5. 7777777
6. 17321
7. 43875
8. 2018655
9. 4741235

Create large numbers and do the same as above.

1. 32,754 ____________
2. ____________
3. ____________
4. ____________
5. ____________
6. ____________

Ordering Numbers

If you had to choose the larger number, would you choose **25,987** or **110,102**? If you picked 110,102 you are correct. How did you compare these numbers?

One way to compare two numbers is to compare the digits that make up the number going from left to right.

Compare the numbers **711** and **13**.

As we compare these two numbers, we can quickly see that the number **711** has a **7** in the hundreds place and there is no number in the hundreds place in the number **13**. Therefore **711** is larger then **13**.

We can also say that **13** is less than **711** and that **711** is **not equal** to **13**.

Mathematical symbols are used when working with relationships between numbers.

Four terms are used when comparing numbers:

Is greater than	>	713 > 11	**713 is greater than 11.**
Is less than	<	11 < 713	**11 is less than 713.**
Is equal to	=	11 = 11	**11 is equal to 11.**
Is not equal to	≠	11 ≠ 713	**11 is not equal to 713.**

Practice: In the problems below, write > (greater than) or < (less than) in the space provided.

1. 31 __>__ 13
2. $62.32______$29.99
3. 2,067_____2,607
4. 81,321______81,330
5. $51.29___$57.92
6. 35,356______35,365

In the problems below, write = (equal to) or ≠ (not equal to) in the space provided.

1. 57_______59
2. $32.89______$69.99
3. 2,067_____2,607
4. 102,100______102,110
5. $42.29___$42.29
6. 35,356______35,365

Number Sentences

The symbols that you have just learned are used in writing number sentences.

Number sentences are called **equations** or **inequalities**.

Examples of Equations	Examples of Inequalities
$14 = 7 + 7$	$14 \neq 7 + 2$
$3 \times 8 = 24$	$3 \times 4 \neq 20$

To figure out if a number sentence is true or false, do the operation. In the first equation, $14 = 7 + 7$, you would first add **7** and **7**. You would get 14 so the equation is true.

$14 = 7 + 7$

$14 = 14$

Check the second equation to see if it is true.

$3 \times 8 = 24$

______ $= 24$

Now let's look at the inequalities and see if they are true.

$14 \neq 7 + 2$

$14 \neq 9$

Since 14 does not equal 9, the inequality is true.

Check the second inequalities to see if it is true.

$3 \times 4 \neq 20$

______ $\neq 20$

Number sentences can also use the greater than (>) and less than (<) symbols. Look at the inequalities in the last example. They can be restated.

$14 \neq 7 + 2$	$14 > 7 + 2$
$3 \times 8 \neq 20$	$3 \times 4 < 20$

Practice: Decide if the following are true or false. Circle T for True or F for False.

1. **a.** $3 + 2 = 5$ T F
   b.. $3 + 2 \neq 5$ T F
   c. $3 + 2 > 5$ T F
   d. $3 + 2 < 5$ T F

2. **a.** $23 = 7 \times 3$ T F
   b. $23 \neq 7 \times 3$ T F
   c. $23 > 7 \times 3$ T F
   d. $23 < 7 \times 3$ T F

Notice that in the first set, only one example was true. How many were true in the second set of problems?

Sometimes it is confusing to think of an **inequality** as true. Think them through carefully.

It is true that 3 plus 2 does not equal 8. Therefore $3 + 2 \neq 8$ is a **true statement**.

Practice: Circle T for True or F for False.

1. $48 + 13 \neq 61$ T F
2. $27 \times 10 = 270$ T F
3. $32 \div 8 > 4$ T F
4. $17 \times 4 < 40$ T F
5. $72 - 10 = 62$ T F
6. $99 + 1 > 100$ T F
7. $38 - 18 \neq 20$ T F

Make these mathematical sentences true. Use =, ≠, >, or <. The first one is done for you.

1. $\mathbf{5 + 9 = 14}$
2. 8×5 ___ 40
3. 2×10 ___ 25
4. 38 _____ 2×19
5. 75 _____ 3×25
6. 3×9 ___ 31
7. 60 _____ 5×11

Make these mathematical sentences false. Use =, ≠, >, or <. The first one is done for you.

1. $\mathbf{5 + 9 \neq 14}$
2. 8×5 ___ 40
3. 2×10 ___ 25
4. 38 _____ 2×19
5. 75 _____ 3×25
6. 3×9 ___ 31
7. 60 _____ 5×11

Writing Whole Numbers

"Julie, how much is your electric bill this month?"

"Well, the bill came to one hundred twenty-six dollars, but Mika owes me forty-seven dollars from last month's bill. I only need to save seventy-nine dollars this month. Mika will pay me Thursday and then I'll write my check for one hundred twenty-six dollars."

Often it is necessary to write and read whole numbers in words. When Julie writes her check out to the electric company, she will have to be able to write the numbers. Checks, money orders, and other numerical information often need numbers of amounts written as words. It is also important to be able to read numbers that are written as words.

- Numbers **1** through **20 and 30, 40, 50, 60, 70, 80, and 90** are written as follows:

one
two
three
four
five
six
seven
eight
nine
ten

eleven
twelve
thirteen
fourteen
fifteen
sixteen
seventeen
eighteen
nineteen
twenty

thirty
forty
fifty
sixty
seventy
eighty
ninety

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- Numbers **twenty-one (21)** through **twenty-nine (29)** have a hyphen (–). So do thirty-one **(31)** through thirty-nine **(39)** and so on through ninety-nine **(99)**.

  Examples: thirty-three (33), fifty-two (52), forty-six (46)

  Using the examples above, write your age:______________

- Don't use the word **and** when writing numbers.

  Three hundred thirty-four (334) not three hundred and thirty-four.

  Write the following numbers in words:

1. **73**____
2. **14**____
3. **305**____
4. **82**____
5. **36**____

- Use a **comma** after writing the word **million** and **thousand**. **Example: One million, seven hundred thirty-three thousand, two hundred forty-nine = 1,733,249.**

Activity: Writing Numbers

Follow the preceding example and write the following numbers in words.

1. **34,208**____
2. **143.812**_______________________________________
3. **99,999**____
4. **1,244**____
5. **2,111**____

The following numbers are written in words. Rewrite them using only numbers. Follow the example. Remember to place the commas after millions and thousands.

1. **four hundred thirty-two** 432__________________________
2. **One hundred forty-three thousand, seven hundred sixty**________

   ____
3. **fifteen**____
4. **four million, two hundred six thousand**___________________

   ____
5. **nine hundred seventy one**______________________________

   ____

Estimating and Rounding Numbers

- What Do You Know?
- Estimating
- Rounding Numbers
- Estimating on Graphs or Charts
- Real Life Problems
- Create Your Own Problems

Estimating and Rounding Numbers

What Do You Know?

Answer the questions below. They will give you an idea of what you know about estimating and rounding numbers. Check your answers and ask yourself if they make sense.

1. What does it mean when you receive an estimated utility bill, such as an estimated electric bill?____________________________________

____

Mental Math: Answer questions 2, 3, and 4 in your head. Use mental math; do not use paper and pencil to work your answers.

2. If you needed several notebooks, and one notebook cost **$2.89**, about how much would **6** notebooks cost?____________________________

3. You are at the grocery store. You only have **$10.00** with you and you do not have paper and pencil. Do you have enough money to buy the following items: **mustard, $ .63** **milk, $2.29** **sliced roast, $4.79** **tuna, $1.19** **cherry pie - $2.99?**

____

1/4 lb. Hamburger			**$2.59**			
1/4 lb. Cheeseburger			**$2.79**			
Fries	**Sm.**	**$ .99**	**Med.**	**$1.19**	**Lrg.**	**$1.29**
Coke	**Sm.**	**$ .79**	**Med.**	**$ .99**	**Lrg.**	**$1.19**

4. Using the above chart, estimate your bill for the following items:

- **1/4 lb. Hamburger, 1 Med. Fries, 1 Lrg. Coke.**____________________

- A ***Value Meal*** includes a **1/4 lb. Cheeseburger, Lrg. Fries,** and **Lrg. Coke**. If it costs **$3.99**, is it a better deal than the order above? *(Remember not to use paper and pencil)*____________________

5. You have a new TV set. It will only fit against the living room wall that has no windows. The electrical outlet is on another wall, away from where you want to put the TV. How can you estimate the distance between the TV and the electrical outlet to see if the cord will reach?

____

____

____

____

Estimating

We work with numbers all the time and often it is not important to use exact numbers. We may not know or even need the exact number.

Why Do We Estimate?

There are times when we need to use **exact numbers.** Here are some examples:

- Fares for train or subway.
- Paying the baby-sitter.
- Measuring the floor for a rug or linoleum.

Often, we ***don't*** need exact numbers. When we don't need the exact number, or we don't know the exact number and want to **approximate** or get close to it, we **estimate**. Here is an example:

- "I went to the store this morning and there must have been **300** people there."

It is possible that the **exact** number of shoppers was **289,** but for the purpose of describing the crowd, an estimate of **300** gives the listener a good idea of how many people were in the store.

When you are in the grocery store, you need to know if you have enough money to buy what is in your cart. You can come close to the total without needing to add to the exact penny. This is another example of estimating.

Which would you say? Circle your answers.

• I got up at 8:02.	or	I got up around 8 o'clock.
• I spend $61.32 a week on food.	or	I spend between $60 and $70 weekly on food.
• It's 11:03. Are you ready to go?	or	It's a little after 11:00. Are you ready to go?

Numbers that are not exact are estimates.

Other Examples of Estimating

- Estimating distance, such as how far it is between home and City Hall.
- Giving directions, such as estimating how many blocks someone should go before making a turn.
- Planning one's time, estimating how long it will take for a chore, errand, or task to be done.
- Estimating how long it will take to get from one location to another on foot, in a car, or by bus.

Estimating Worksheet

Write about some of the ways you use estimating in your daily life. Some ways might include cooking, buying food, and looking at time. Work with a math partner, the class, or alone.

Key Words

There are key words and phrases which are clues to tell you that an exact number is not necessary. They include **about, approximately, around** and **on average.**

Can you think of any others?____

____

Deciding When to Estimate

In each of the following situations, decide if you can use an **estimated** number or if you need an exact number. Circle your answers.

1. How much does the subway ride cost for two adults?

   a. estimate　　　b. exact

2. Do you have enough money with you to buy groceries?

   a. estimate　　　b. exact

3. When you bought groceries, how much change did you receive?

   a. estimate　　　b. exact

4. What time does your bus leave the bus terminal?

   a. estimate　　　b. exact

5. How long does it take you to get downtown by bus?

   a. estimate　　　b. exact

6. How much time does it take you to bake a cake?

   a. estimate　　　b. exact

7. How much flour do you need for the cake?

   a. estimate b. exact

8. Your baby is sick. Your doctor asks if the baby has a fever.

   a. estimate b. exact

9. You know it's cold outside. What kind of coat should you wear?

   a. estimate b. exact

10. You are going to the movies. When does the movie start?

    a. estimate b. exact

11. Your nephew has done some odd jobs for you. He gets paid by the hour and wants you to pay him for the work he has completed.

    a. estimate b. exact

Sometimes it is important to know **exact numbers**. If your baby is sick, it is important for the doctor to know that the baby's temperature **is** 104° and not **about** 100°. On the other hand, it is not that important if you know whether it is 33° or 36° outside before you leave the house. Your **experience** tells you that it is cold outside and you will need a coat.

Life experience can help us to decide when we need **exact numbers** and when we can **estimate** something. Our experience and our knowledge of things helps us to estimate.

Estimation is something we can learn to do. Our skill at estimation can get better with practice. For example, you probably use your experience to **estimate** how long it will take to get to work.

- You can estimate how long it will take you to get ready for work in the morning because you have had experience getting up and preparing to leave the house.

- While the schedule may say that the bus leaves your stop at 7:42 a.m. and arrives at your job at 8:06 a.m., your experience tells you that if it's raining or there is a lot of traffic the bus will be late.

Perhaps on your first day of work you trusted the bus schedule's exact numbers and were late for work. Your experience will tell you to include more time in your estimate for how long it will take you to get to work the next day.

Practice Estimating

- **Saturday Shopping Trip**

One way to use estimating is to plan the use of your time. Make a schedule for a Saturday shopping trip on the Schedule Worksheet on the following page. Estimate the time that each activity—such as traveling on a bus or shopping for dinner—will take. If you plan to bring children or a friend along, don't forget to add time to your estimates. Specifically:

1. Make a list of all of the things that you have to get done during the day. Then write down an estimate of the time you think it will take you to perform each task or activity.
2. After you accomplish each activity, write the actual time it took and any comments that might help you to estimate more closely in the future. **Example:**

Activity	Estimated Time	Actual Time	Notes
Get up, dress, eat breakfast	1 $^1/_2$ hr.	45 minutes	skipped breakfast
Bus to downtown	30 minutes	1 hour	bus late, slow
Lunch with Diane	1 hour	1 $^1/_2$ hours	talked about Ray
Stop at grocery store	45 minutes	30 minutes	hooray - no lines
Pick up kids at mom's	15 minutes	1 hour	cup of coffee, talk
Totals:	**4 hours**	**4 hours, 45 minutes**	

Schedule Worksheet

Activity	Estimated Time	Actual Time	Notes

Total estimated time:______________ Total actual time:________________

Practice: Estimating

We can use household and other familiar objects to practice estimating skills.

You will need:

1 small snack-size box of snack raisins
1 large box of raisins
1 1 lb. box of elbow macaroni

How Many Raisins in a Snack Box?

1. Look at the snack-size box of raisins. Estimate (guess) how many raisins are in the box. Write your estimate on a piece of paper.

2. After you have written down your estimate, count the raisins in the snack box.

3. You now know how many raisins are in the snack-size box. Look at the large box of raisins. Compare the small box to the large box. Can you estimate how many raisins are in the large box? Write your estimate down.

4. If you are working in class, the class can divide into teams and work together to come up with team estimates.

How Many Pieces of Macaroni in a 1 Pound Box?

Look at a 1 lb. box of elbow macaroni. This box should have a window in the front that shows some of the macaroni inside the box.

1. Count the macaroni that you see in the window.

2. Now that you know how many individual pieces of macaroni are in the window, estimate how many pieces of macaroni are in the whole box.

3. Record your estimate and share it with your classmates.

4. To find out how close your estimate is, divide the contents of the macaroni box among the class members and ask them to count the number of macaroni pieces they have. Compare the estimates with the total count.

Who Uses Estimating?

Choose one or more of the following and list ways they use estimation.

Mechanic____
Painter____
Butcher____
Mother____

We need to estimate for certain jobs or chores. Some people use numbers every day for the same type of task so they become very good at estimating.

Here are some examples:

- A baker can estimate a teaspoon of salt.
- A painter can measure a room and estimate how much paint it will need.
- Someone who sews often can estimate how much material is needed for a shirt or pants.
- A father can estimate the family's grocery bill from the shopping list.

Can you think of other ways that you or someone you know is good at estimating? Does your job or someone else's rely on estimating?

____

____

____

The more we work with numbers, the more we can use estimation to make working with numbers easier.

More Practice Estimating

Now, let's learn to estimate in centimeters.

This line is 3 centimeters long. ____________

This line is 6 cm (centimeters) long. ________________________

How long is this line? ________

Now draw a line 5 cm long in the box below.

The line below is 8 cm long.

____

About how long is this line? ________________

About how long is this line? ___________

Draw a line 7 cm long in the space below.

You just taught yourself to **estimate** centimeters.

Rounding Numbers

Rounding numbers is a way to make them easier to use. Rounding is helpful when an exact number isn't necessary.

Here is an example: The number **289** can be rounded to **300**.
It is closer to **300** than **250** or **200**.

As we have seen, sometimes we don't need an exact number. You round a number so that you have zeros at the end of the number — for example, **289**, **304**, and **610** become **300**, **300**, and **600**. This makes working with the numbers easier.

When Do You Round Numbers?

At a restaurant...

- Adding what items you want to order to check if you have enough money with you.
- Checking the total on the bill.
- Figuring out the tip.

In the grocery store...

- Adding up groceries before you purchase them.
- Figuring out how much is saved on cents-off coupons.

- **List other times when you round numbers.**

____

____

____

Steps for Rounding Numbers:

1. Mark the digit in the place to which you want to round.
2. If the digit to the right of the marked digit is 5 or more, add 1 to the marked digit.

   If the digit to the right of the marked digit is less than 5, do not change the marked digit.
3. Replace the digits to the right of the marked digit with zeros.

Examples:

Using the steps above, round **729** to the nearest **hundred**.

1. 729 Mark the digit 7 in the hundreds place.
2. 729 Look at the digit to the right of the 7, which is the digit 2. Is it 5 or less? Since it is less than 5, do not change the 7.
3. 700 Replace the digits to the right of the 7 with zeros.

Let's look at these steps again with another number. Round **1,689** to the nearest **thousand**.

1. 1,689 Mark the digit 1 which is in thousands place.
2. 1,689 Look at the digit to the right of the 1, which is 6. Is it 5 or more? Since it is more than 5, we add 1 to the 1 in the thousands place to get a 2.
3. 2,000 Replace the digits to the right of the 2 with zeros.

Here is another way to show how to round numbers.

To round the number **289** to the closest hundred, first put it in a row with the numbers that are the closest hundreds to it.

It will look like this: 300
289
200

If we are talking about money, which dollar amount would be closest to $289?

$300	$ 11 more - **closer**
$289	
$200	$ 89 less - not as close

So **$289** rounded to the nearest **hundreds place** is **$300**.

Now let's try rounding **304** to the nearest **tens** place.

310	6 away, not as close
304	
300	4 away - **closer**

So **304** rounded to the nearest **tens place** is **300.**

Practice: Rounding Numbers

1. Round each number to the nearest **ten**.

a. 37	b. 8,232	c. 46	d. 102
________	________	________	________

2. Round each number to the nearest **hundred**.

a. 510 b. 78,327 c. 219 d. 2,168

__________ __________ __________ __________

3. Round each number to the nearest **thousand**.

a. 23,587 b. 5,802 c. 321,854 d. 1,714

__________ __________ __________ __________

4. Round each number to the nearest hundred-**thousand**.

a. 754,844 b. 325,999 c. 1,232,542 d. 672,203

__________ __________ __________ __________

5. Round each number to the nearest **million**.

a. 4,212,638 b. 8,932,507 c. 43,267,945 d. 283,348,321

__________ __________ __________ __________

Rounding Numbers with 9's

Let's now look at what happens when we use the steps above to round the number **9**.

If we are rounding **396** to the closest **ten**:

1. 396 Mark the digit 9 in the tens place.
2. 396 Look at the number to the right of the 9, which is the 6 in the ones place. Is it 5 or more? Since it is more than 5, we add 1 to the 9 in the tens place. The 9 becomes **10**.
3. 400 To show this, we put a 0 in the tens place and carry the 1 to the hundreds place, which changes the 3 to a 4. We then replace the digits to the right of the 4 with zeros.

The number **396** rounded to the nearest **ten** becomes **400**.

Let's look at these steps again with another number. Round **1, 978** to the nearest **hundred**.

1. 1,978 Mark the digit 9 which is in hundreds place.
2. 1,978 Look at the number to the right of the 9, which is the number 7 in the tens place. Is it 5 or more? Since it is more than 5, we add 1 to the 9 in the hundreds place. The 9 is now a 10.
3. 2,000 To show this, we put a 0 in the hundreds place and add 1 to 1 in the thousands place, which changes the 1 to a 2. We then replace the digits to the right of the 2 with zeros.

The number **1,978** rounded to the nearest **hundreds** is **2,000**.

Practice: Rounding Numbers with 9

1. Round each number to the nearest **ten**.

a. 595 b. 78,389 c. 296 d. 2,199

__________ __________ __________ __________

3. Round each number to the nearest **hundred**.

a. 23,978 b. 5,699 c. 321,769 d. 1,999

__________ __________ __________ __________

4. Round each number to the nearest **ten-thousand**.

a. 798,765 b. 398,976 c. 1,299,888 d. 677,989

__________ __________ __________ __________

5. Round the money amounts below to the nearest **dollar**. In example (**d**), the number is written to the hundredth cent as is often seen on the pump for the price of a gallon of gas.

a. $29.99 b. $98,876.98 c. $68.79 d. $1.298

__________ __________ __________ __________

6. Make up your own numbers and practice rounding to the nearest **ten, hundred, thousand, hundred-thousand,** and **million.**

Number	Place Rounded to	Rounded Number
72,380	tens place	72,380

7. Write two word problems which ask you to use what you know about rounding numbers.

Example: You are at the grocery store. You only have **$10.00** with you, and you do not have paper and pencil. Do you have enough money to buy the items below?

mustard, $ .63 milk, $2.29 sliced roast beef, $4.79
tuna, $1.19 cherry pie - $2.99

A. ______________________________

B. ______________________________

Estimating on Graphs or Charts

Graphs and charts organize numerical information so that we can easily read and compare it. The numerical information on a graph or chart is an **approximation** or **estimate**. The symbols represent rounded numbers. Our practice with estimating and rounding will help us to understand charts and graphs better. Example:

Casino Earnings from Slot Machines in 1992
Atlantic City, New Jersey

Each $ = $1,000,000

Trump Plaza	$ $ $ $
Caesar's	$
Trop World	$ $ $
Trump Taj	$ $

SOURCE: NEW JERSEY CASINO CONTROL COMMISSION

As noted on the table, each **$** (dollar sign) represents **$1,000,000** (one million dollars) that the casinos earned from players of the slot machines. We can quickly compare casino earnings by counting the number of dollar signs. For example, Trump Plaza earned twice as much as the Trump Taj— $4,000,000 (four dollar signs) compared to $2,000,000 (two dollar signs). In comparing the take of the different casinos, it is not important that we know that the Trump Plaza earned exactly $4,089,323. The rounding of the numbers and their representation through pictures or symbols allows us to make the comparison easily.

Real Life Problems

1. At the gas station, there are three different prices for gasoline: $1.299 a gallon for premium, $1.199 a gallon for medium grade, and $1.099 a gallon for regular. Our money system doesn't use hundredths of a cent. Round the prices of each gasoline to the nearest cent.

   $1.299____________ $1.199____________ $1.099____________

2. Caroline wants to purchase a new sofa at a department store. The sofa costs $299.00. There is also a matching chair at a cost of $49.00. She has $325.00 so far. About how much more money does Caroline need to buy both the sofa and the chair?____________________

3. Patricia earns $426.38 a week. Round Patricia's weekly salary to the nearest hundred dollars.______________________________________

4. Patricia's brother James makes $1,532 a month. Round James' salary to the nearest hundred.______________________________________

5. The average rent of a new apartment with utilities is $575.00. Round the cost to the nearest ten.__________________________________

6. Maxine is shopping and has three items she wants to buy:

   toothpaste ($1.29) face soap ($ .79) lipstick ($3.89)

   Round the price of each item to the nearest dollar amount. How many dollars does she need? __________________________________

Create Your Own Problems

Divide into small groups and write word problems from your own lives that require rounding numbers. Use more paper if you need additional writing space.

A. ____________________

B. ____________________

Using a Calculator

- What Do You Know?
- When to Use a Calculator
- How to Use a Calculator
- Setting up the Problem
- Real Life Problems

Using a Calculator

What Do You Know?

Answer the questions below. They will give you an idea of what you already know about using a calculator. As you check your answers, remember to ask yourself if they make sense.

- *You will need to use a calculator to answer the questions.*

1. What keys do you press to enter the dollar amount **$2,748.83**? Fill in the blanks below.

   [ ] [ ] [ ] [ ] [ ] [ ] [ ]

   Did you remember to enter the decimal point?____________________

2. Do you need to enter the dollar sign?__________________________

3. Do you need to enter the comma after the digit 2?_________________

4. The **(+)** key is called the add key or the addition key and allows us to add numbers. What is the **(-)** key called and when would you use it?_____

5. What is the **(=)** key called and when would you use it? ____________

   ____

6. Write the number and function keys that you use to answer the following calculations in the spaces provided. The first one is done for you as an example.

   Tip: The number of spaces provided can help you figure out how to fill out the answer. Don't forget your **equal sign** for each problem. Also you do not need to calculate these problems now.

   a. seventy-three minus twelve

   (7) (3) (-) (1) (2) (=)

   b. eighteen plus thirty-two

   ( )( )( )( )( )( )

   c. six-hundred twenty-nine plus four

   ( )( )( )( )( )( )

   d. thirty-six dollars divided by four

   ( )( )( )( )( )

7. Solve the following problems using your calculator.

   a. 73 - 29 =

   b. 832 ÷ 4 =

   c. 49 x 7 + 3 =

   d. 232 + 3,213 + 42 =

   e. 237,203 + 6,910 =

   f. Darlene gained 18 pounds in the first five months of her pregnancy. She has four months remaining of her pregnancy. She plans on gaining only three pounds each month for the remaining four months. Using your calculator, figure the total number of pounds that Darlene wants to gain during all nine months of her pregnancy._____

8. Which problems below are answered incorrectly? Use your calculator to check the answers.

a. $$\begin{array}{r} 2{,}466 \\ +\ \underline{8{,}233} \\ 9{,}669 \end{array}$$

b. $$\begin{array}{r} 17{,}854 \\ -\ \underline{6{,}589} \\ 11{,}265 \end{array}$$

c. $$\begin{array}{r} 42{,}328 \\ 4{,}824 \\ +\ \underline{56{,}391} \\ 72{,}433 \end{array}$$

d. 71 x 16 = 1,136

e. 2,464 ÷ 2 = 1,231

f. 36 - 18 = 16

Why Use A Calculator?

This chapter focuses on some of the functions that are common to most calculators and provides a brief overview of how calculators are used.

We work with numbers all the time, whether we are at home, at school, or at work. In learning about estimating and rounding, we learned that it is often not important to have exact numbers. There are times when we do not know or even care what the **exact** number is, and we estimate to get the answer.

There are also times when we do need exact numbers, and we compute (do or figure) the problem in our heads, on paper, or with a **calculator**. In any case, it is important to have an idea of what our answer should be. This helps us to know if we are doing the problem correctly.

Activity

Use your estimating skills to work out the problems below. Circle the number that is the closest to your estimate of the answer. If you have difficulty remembering how to estimate, refer back to the steps in "Estimating and Rounding Numbers."

812 + 104 =	700	800	900
38 x 5 =	20	200	2,000
453 – 50 =	400	450	500

Estimating and Using the Calculator

As we discussed, it is good to estimate **before** you use your calculator. This will help you to figure out if you used the calculator correctly and did not miss any of the numbers. Your second step would be to solve the problem with the calculator and compare your answer with your estimate. They should be close.

For each problem below, circle the number which is closest to your estimate. Then work the problem on your calculator. Some of the choices below are incorrect because a mistake was made on the calculator. Can you guess what mistake was made to get the incorrect answers?

10 + 4 =	5	6	14	
812 + 104 =	708	826	916	
38 x 5 =	43	33	190	7.6
453 – 50 =	503	403	458	448

Computing Problems

It is important to know how to go about solving a problem. Knowing how to do, or compute, a problem can help us when we need to work with numbers in other areas of our lives.

Look at the following examples. Match each statement with its correct computation.

1. Alex had $10.00. He lost $4.00. How much does he have?
2. Vanessa had $10.00. She found $4.00. How much does she have?
3. Sandy saved $10.00 each week for 4 weeks. How much does she have?

a. 10 x 4 = 40
b. 10 – 4 = 6
c. 10 + 4 = 14

Remember to first estimate and then use the calculator. If your answer is close to the estimate, you will know that you have computed the problem correctly on the calculator.

As an example, if you were adding 57 + 79 + 21, you could first estimate by rounding the numbers to 60 + 80 + 20. It's easy to add in your head 6 + 8 + 2 which equals 16. Now we add a zero making our estimate 160. If you use the calculator and come up with an answer of 1,570, you know from your estimate, you have made an error. Now you can recheck your calculations with the calculator.

Examples

Here is an example of using estimation along with your calculator:

- You have worked part-time for a store over the holidays. To be eligible for a bonus, you have to work 50 hours during December. Estimating will help you know whether it's worth taking the time to add up your exact hours. After estimating the number of hours you have worked, you can use your calculator to find the exact number to see if you are eligible for the bonus.

Your hours for December are:

8 17 23 2

Is it worth doing the exact calculation? In other words, is your estimate close to 50?

Did You Know?

- It has been widely shown by math teachers[3] that having the **knowledge** and **ability** to use a calculator correctly, helps math learners better understand the math that they are studying.
- Students who use calculators, even if they are not allowed to use them during a test, **score higher** than students who do not regularly use calculators. Another important reason to master the calculator!

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[3] Manly, Myrna. *Problem Solving for the GED*. Chicago, IL: Contemporary Books. 1993.

When to Use a Calculator

We estimate to get a ballpark number, or a good idea, of the number we need, but if we need an exact number, we can use a calculator for a **quick** and **exact** answer. Here are some of the ways using a calculator can come in handy:

- measuring carpeting, wallpaper, wood, fabric
- computing taxes, balancing checkbooks
- adding up work hours for a time sheet
- figuring out percentages
- totaling a grocery order

Can you think of other times you could use a calculator?

____

____

____

____

Being able to use a calculator correctly and easily is necessary in our world. Using a calculator will enable you to do calculations quickly and accurately, giving you time to think about the problem rather than the computation. It will free you to use your critical thinking and math skills to set up problems and consider what you are doing to solve the problem.

Although you may be able to add several large numbers very well, it is faster to use a calculator than to take the time to add the numbers with a pencil and paper.

- **Try this:**

1. Add the following numbers using a pencil and paper.

   34,521 + 87,389 + 12,674 + 73,909 =

2. Now, use a calculator to add the numbers. Compare how long the problem takes on the calculator with how long it took on paper.

   If you don't know how to use a calculator, ask someone in the class to do the problem with you. You will learn how to use a calculator later in this chapter.

Calculator Tip

- Sometimes people add things twice on the calculator to see if they get the same answer. By first estimating your answer, you will have a better idea of what the correct calculator answer should be. This will help you if you happen to make the same mistake or a new mistake the second time you do the calculation.

How to Use a Calculator

Turning Your Calculator On

If the calculator you are using has a battery, it will have **ON** and **OFF** keys or one **ON/OFF** key. When you press the **ON** key, the display window should show a **0**.

If there is nothing in the display window when you turn your calculator on, check to see if the battery needs replacing.

If your calculator is **solar-powered**, you will need to work in a room that has good light.

Solar-powered means that your calculator has cells that absorb and use light to power the calculator. Some solar-powered calculators also have a battery as a back up for the solar cells. Solar-powered calculators either have **ON** and **OFF** keys or they turn on when you open the calculator cover, exposing the **display window** to light. If there is not enough light, a solar-powered calculator will not work. This is a disadvantage of a solar-powered calculator, but the advantage is that you never have to change a battery!

Digit Keys

Now look closely at the calculator (your own or the diagram on this page). Most calculators have several keys in common. All calculators have the ten **digit keys**: **0, 1, 2, 3, 4, 5, 6, 7, 8, 9**. The digit keys are used to enter numbers into a calculator. Find each digit key on your calculator.

Digit keys are also found on other machines. Some examples are: cash registers, automatic teller machines (ATM's), telephones, TV remote controls, and computer keyboards. Do you use other machines that have the same digit keys?

____

____

____

Now that you have identified the digit keys, play with your calculator. Press some of the digit keys and see how your calculator works. Press other keys and see if you can figure out what they do or what their **functions** are.

- What happens when you press the **2** and the **+** key and the **6** and the **=** key?
- Try other digits and keys: **– ÷ X %**

Let's look at how numbers are entered into the calculator. Enter one digit at a time.

Example: Enter your age. If you are **28**, first press the digit **2** and next press the digit **8.**
28 should show up on the **display window**.

Clear (C), All Clear (AC) Key

To clear a display of numbers that you no longer want, press the **clear key**, the **C** key on the calculator. Find the **C** key on your calculator. **Press** it and see how the numbers on your display window disappear. You have cleared the numbers, or erased them. Everyone makes mistakes and this key erases mistakes and allows you to enter new numbers. Your calculator might have an **AC**, or **all clear**, key which works the same way.

Calculator Tip

- **It's best to press the AC or C key before each problem.**

  This ensures that the calculator is working with only the numbers that you want. It will be a clean slate, with no numbers remaining in the calculator from another calculation.

Practice:

Enter and clear the following numbers on your calculator. Notice that you **do not include the comma** when entering numbers in a calculator.

a. 34
b. 47
c. 386
d. 710
e. 213
f. 5,870
g. 6,895
h. 2,110
i. 32,579
j. 89,909
k. 269,541
l. 677,900

Enter your own numbers into the calculator and then clear them from the display window. Write down the numbers you make up.

_______________ _______________ _______________

_______________ _______________ _______________

_______________ _______________ _______________

CE or Clear Entry Key

Your calculator might also have a **CE** key. The **CE** key allows you to clear or erase the **last number** you entered.

If you have a **CE** key, try the following:

1. Enter your age.

2. Press the **+** key.

3. Enter a friend's age. As an example for now, use 32 for your friend's age.

   Note: Your calculator may automatically add after two or more numbers have been entered. Thus, your display screen might read your age ***plus*** *32. Don't worry because the next steps will clear your calculator the same as if it did not add the numbers before you press the "=" key..*

   Suddenly, you remember that your friend is now **33**, not 32. Don't press any other keys yet.

4. Now press the **CE** key **only once** and the 32 will be erased. You may now enter **33**.

   The calculator will remember the first number. You will not have to re-enter your age. The number will still be in the calculator's memory. Only the last number, **32**, will be erased, allowing you to enter the correct number, **33**.

Some calculators add or tally numbers as they are entered. If the calculator you are using works this way, you do not need to press the **(=)** key. If your calculator hasn't given you the answer after you entered the last number, press the **(=)** key for the total. You will have added your age and your friend's age.

The total of your age plus 33 is ___________.

Calculator Tip

- Don't forget to **clear** your calculator before going on to another problem!

Try adding other numbers. Here is another example:

Cindy's children are ages **4, 7, 12.**

Press keys: **4 + 7 + 12.**

Do not press the + key after you enter 12. The display will read **12 which is the last number entered.**

Press the **CE** key. The display will now read **11.** The number **12,** the last number you entered has been cleared.

Now enter **13 and press the (=) key**. The answer will be **24**.

Many calculators have a **CE/C** key.

If you press the **CE/C** key **once**, it will **clear entry**, or **CE**. In other words, it will erase the last number you entered, in the same way as the **CE** key, and you can continue with your calculations.

If you press the **CE/C** key **twice**, it will **clear all of the numbers which you have entered.**

Practice:

If your calculator has a **C/CE** or **CE** key, do the following practice.

Make up numbers that you want to add. Use the **CE** key to change the last number you entered. Don't forget to use the **(+)** key between each number that you want to add. Press the **(=)** key to get your answer.

Example problems

1. Enter **12 + 24 + 16**; press **CE** and change **16** to **15**. Press the **(=)** key. Your answer should be **51**.
2. Enter **67 + 83 + 94 + 102**; press the **CE** key and change **102** to **104**. Press the **(=)** key. Your answer should be **348**.
3. Enter **379 + 490**; press the **CE** key and change **490** to **493**. Your answer is______________________________.

The calculator helps you add several large numbers quickly and accurately.

Calculator Tip

- Remember, you can only **clear** or erase the last number entered with the **CE** key. If you **do not** have a **CE** key, then you cannot erase the last number entered. If you press the **C** key, it will erase **all** of your calculations.

Now try making up your own addition problems using the **CE** and **C** keys. Write them in the space below. If you have a math partner in class, work together to create problems for each other.

______________ ______________ ______________

______________ ______________ ______________

______________ ______________ ______________

Before starting any problem remember:

- **If your calculator has an AC, or all clear key, use that to clear your calculator.**
- **Estimate the answer first, then use the calculator. The answers should be close. This means that you are using the calculator correctly.**

Setting Up the Problem

Your calculator has four **function** keys: **+** (addition), **−** (subtraction), **x** (multiplication), and **÷** (division). Lets look at these keys and how they are used to set up specific number problems.

Function Key (+) Addition

You have already used the **+** function key. Follow the directions to solve this additional problem: **66 + 82 = ?**

Steps	Display
Enter (C) clear.	
Enter the number **66**.	**66**
Press **+**	
Enter the second number, **82**.	**82**
Press **=**	**148**

Note: Some calculators add numbers as you enter them, giving you a running total. If your calculator does this, you will not need to press the equal key.

Practice:

a. 66
+ 33

b. 328
+ 779

c. 63,754
7,433
98,529

d. 743 + 32 + 398 =

e. 1,258 + 3,567 + 873 =

f. 42 + 157 + 77 =

Work with your math partner to create addition problems. Write your work in the space below. Use more paper if necessary. Estimate your answers before using the calculator.

____________________ ____________________ ____________________

Function Key (–) Subtraction

Follow the directions to solve this subtraction problem: **82 – 63 = ?**

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number **82**	**82**
Press the – key.	
Enter the next number, **63**	**63**
Press the = key.	**19**

Practice:

a. $\begin{array}{r}59\\ \underline{-\ 31}\end{array}$ b. $\begin{array}{r}685\\ \underline{-\ 430}\end{array}$ c. $\begin{array}{r}3{,}285\\ \underline{-1{,}529}\end{array}$

d. 327 – 32 = e. 1,692 – 567 = f. 157 – 42 =

Work with your math partner to create subtraction problems. Write your work in the space below. Use more paper if necessary. Estimate your answers before using the calculator.

____________________ ____________________ ____________________

Function Key (X) Multiplication

Follow these steps to solve the problem: **82 X 63 = ?**

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number **82**	**82**
Press the **X** key.	
Enter the next number, **63**	**63**
Press =	**5,166**

Practice:

a. 66
x 33

b. 328
x 779

c. 63,754
x ,433

d. 743 x 32 =

e. 1,258 x 3,567 =

f. 42 x 157 =

Work with your math partner to create multiplication problems. Write your work in the space below. Use more paper if necessary. Estimate your answers before using the calculator.

Function Key (÷) Division

Division is dividing one number by another. The number being divided is called the **dividend** and the number doing the dividing is called the **divisor**. The answer is called the **quotient**.

Follow these steps to solve the problem: **82 ÷ 2 = ?**

Note: **82** is the **dividend** and **2** is the **divisor**.

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number **82** (dividend)	**82**
Press the ÷ key	
Enter the next number, **2** (divisor)	**2**
Press **=**	**41**

Practice:

a. 48 ÷ 4 =

b. 126 ÷ 3 =

c. 3,285 ÷ 5 =

d. 327 ÷ 3 =

e. 1,692 ÷ 6 =

f. 156 ÷ 12 =

Work with your math partner to create division problems. Write your work in the space below. Use more paper if necessary. Estimate your answers before using the calculator.

____________________ ____________________ ____________________

Function Key (%) Percentage

Calculators can make percents easier to figure out but first you need to determine what type of percent problem you are solving.

Problem 1: 25% of $60.00 = ? Answer: 25% of $60.00 is $15.00

In this problem you are trying to find out how much 25% is of all the money or the $60.00.

Here are the steps to use the calculator to find what part of a whole a percent is for the problem: **25% of $60.00 =?**

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number representing the whole: **60**.	**60**
Press the **X** key	**60**
Enter the number of the percent: **25**	**25**
Press **%**	**15**

Note: On some calculators, you need to press the **=** key to get the answer. Practice with the calculator you use to see if that's necessary.

Practice:

a. 15% of 40 =

b. 12% of 35 =

c. 40% of $79.00 =

d. 50% of $85.50 =

e. 3% of 47 =

f. 30% of $49.99 =

g. Every day Shanta spends 20% of her $12.00 allowance on car fare. How much does Shanta spend on car fare in one day?____________________

How much does she spend if she goes to work five days?____________

h. Jay wants to buy a shirt which originally cost $72.00. It is now on sale and is marked 30% off the original price. How much will he have to pay for the shirt now?__________________________

Problem 2: $15.00 is what percent of $60.00 ?

Answer: $15.00 is 25% of $60.00

In this problem you are trying to find out what percent $15 is of the whole or, in this case, $60.

Here are the steps to find a percent of a whole on a calculator:

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number representing the part. Enter **15**	**15**
Press ÷	**15**
Enter the number of the whole: **60**	**60**
Press %	**25**

Note: On some calculators, you might need to press the = key to get the answer. Practice with the calculator you use to see if it is necessary.

Practice:

a. 18 is what percent of 40?

b. 20 is what percent of 75?

c. What percent of 60 is 15?

d. $36.00 is what percent of $98.00?

e. 24 is what percent of 88?

f. What percent of $56.00 is $8.00?

g. Tony has saved $600. He gives his nephew $250 when he starts college. What percent of his savings does Tony give his nephew?__

h. Margie shopped around before she bought a new dress for the birthday party. She saved $28 on her $230 dress. What percent did she save?________________________

Problem 3: $15.00 is 25% of what number? Answer: $15.00 is 25% of $60.00 **In this problem you are trying to find out what the whole is.**

Here are the steps to find a whole on a calculator:

Steps	Display
Enter **C** or **AC** to clear	
Enter the number representing the part: **15**	**15**
Press ÷	**15**
Enter the percent: 25	**25**
Press %	**60**

Note: On some calculators, you need to press the = key to get the answer. Practice with the calculator you use to see if it is necessary.

Practice:

a. 20% of what number is 40?

b. 18% of what number is 108?

c. $75 is 15% of what amount?

d. $42 is 25% of what amount?

e. 26% of what number is 78?

f. 3% of what number is 12?

g. Pat has paid off her credit card. She paid a total of $16.00 in interest payments on her card. Her interest rate was 12%. What was the total that she owed on her card when she paid the balance? ___

h. Ross's puppy, Germane, gained 4 pounds, which is 45% of the weight that he is suppose to gain in every month. How many pounds total should Germane gain in a month?________________

Write two word problems using what you know about how to use calculators

.

A. ____

____

____

____

____

____

B. ____

____

____

____

____

____

Real Life Problems

Use your calculator to answer the questions below. Estimate your answers before you use the calculator. Remember to clear the calculator before you start each problem.

1. You make $8.40 an hour, and you work 40 hours per week. How much do you make a week?_______________ A year?_____________________

2. Your son wants you to be treasurer of his club. They are collecting cans to recycle for cash to donate to their school for new computers. So far they have earned: September, $234.98; October, $321.67; November, $578.32; and December, $187.65. You need to make a year end treasurer's report.

   What is the total money they have made? __________________________

   They gave the money they made in September to another club. What is the total that they will be donating to the school for computers?

   ____

3. Michelle is driving to New York City from Philadelphia on Saturday. It is 90 miles from her house to New York. If she drives 55 miles per hour, how long will it take her to get to New York City? ____________________

   Hint: This is a division problem. Divide the total number of miles she will travel by the speed (miles per hour) at which she will drive.

   If she stops for lunch for a half hour, how long will it take her to get to New York City? ___________________

4. Robert has asked Rhonda to dinner. He is going to cook. He goes to the market with $30.00. This is what he wants to buy: 3 pounds of steak ($3.89 per lb.); 2 baking potatoes ($ .33 each); lettuce ($1.99); peppers (3 for $2.00); frozen peas ($1.49); French bread ($1.69 per loaf); custard pie ($3.29). How much will he spend on dinner?____________________________

   Will he be able to buy a bottle of red wine for $14.99?________________

   The wine store allows customers to make purchases with a money access card. How much will Robert have to take out of his savings account to buy the wine he wants?______________________________

Measurement and Its Uses

- **What Do You Know?**
- **Why Call a Foot a Foot?**
- **Why Measure?**
- **Measurement of Length**
- **Measurement of Weight**
- **Measurement of Liquid**

Measurement and Its Uses

What Do You Know?

Answer these questions. They will give you an idea of what you know about using different ways to measure. Check your answers and remember to ask yourself if they make sense.

1. Which would you use — a ruler or a yardstick — to measure a piece of material 6 inches long?____________________

   22 inches long?________________

   36 inches long?________________

   3 feet long?________________

2. Your sister asks you to buy 4 yards of lumber. When you get to the lumberyard, you discover that lumber is sold by the foot. How many feet of lumber do you need? ________________

3. Suzanne's new baby, Maxine, weighs 6 lb. 4 oz. The visiting nurse needs to convert the new baby's weight to ounces. How many ounces does Maxine weigh?__________________

4. You need two gallons of milk for the children's birthday party. The store only has quarts. How many quart containers of milk will you need to buy to have two gallons of milk?__________

5. There are 12 ounces of soda in your soda can. How much soda is in the can in cups and ounces? __________________

6. Your daughter is now 48 inches tall? How tall is she in feet and inches?

    ____

7. The dress you are making for your brother's wedding needs 42 inches of lace trim. When you go to the store, they will only sell it to you by the yard. How many yards will you have to buy, even though you will have some lace left over?______________

    How many inches of lace will you have left over?___________

Units of Measure

Measures of Length

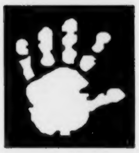
1 foot (ft.) = 12 inches (in.)
1 yard (yd.) = 3 feet
1 mile (mi.) = 5,280 feet

Measures of Weight

1 pound (lb.) = 16 ounces (oz.)
1 ton (t) = 2,000 pounds

Liquid Measures

1 cup (c.) = 8 ounces
1 pint (pt.) = 16 ounces (oz.)
1 quart (qt.) = 2 pints
1 gallon (gal.) = 4 quarts



Why Call A Foot A Foot?

Body Parts and Measurements

Many years ago, when people first started farming and buying and selling land in England, distance and length were measured by using different body parts. One **foot** equaled about the length of a man's shoe or boot. An **inch** was about the length of a finger between the first and second finger joints. An open hand like the one pictured above measured a **span**, the distance between a normal man's little finger and thumb. The distance from a man's nose to his fingertips if he held his arm straight out to his side, is about one **yard** or three feet. This is still a good estimate of a yard. A **pace** was the distance between a man's two feet when he was walking. A **mile** was a thousand paces.

Standard Measurements

These measurements were not standard (always the same) because people's body parts were different sizes but they did give an **estimate** of the **measurement**. If we didn't have **standard measurements**, people's idea of an inch or a foot would depend on the size of their fingers or shoes.

Standard measurement was developed so that measurements would be the same for everyone, always the same size. Now when you ask to buy five feet of pipe or ten inches of ribbon, you know that you will receive a standard measurement wherever you shop. When you buy milk in a half gallon carton, you know that you will receive a half gallon of milk no matter which company's milk you buy!

English and Metric Systems of Measurement

- There are two common types of standard measurement, English measurement and metric. This chapter will focus on English measurement.
- English measurement is the standard of measurement that is used in the United States. It is called the English measurement system because it was used in all of the countries that once belonged to the British Empire. Few countries besides the United States use it today. Most countries use the metric system.

Measurement of Length

Standard Units of Length

Unit	Abbreviation	Description
inch	in.	12 in. = 1 ft. 36 in. = 1 yard (yd.)
foot	ft.	1 ft. = 12 in. 3 ft. = 1 yd. 5,280 ft. = 1 mile (mi.)
yard	yd.	1 yd. = 36 in. 1 yd. = 3 ft. 1,760 yd. = 1 mi.
mile	mi.	1 mi. = 5,280 ft. 1 mi. = 1,760 yd.

Measuring with an English Ruler

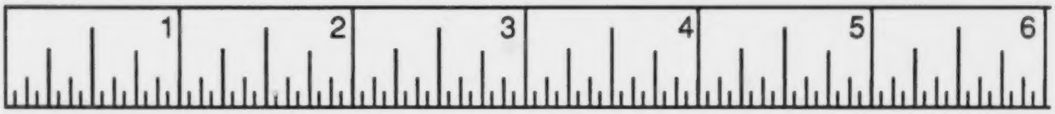
Rulers are used to measure length. English rulers are usually 12 inches—or 1 foot— long and measure inches. Yardsticks are 36 inches long—3 feet or 1 yard—and are used to measure inches, feet, and yards. Measuring tapes can be very long—up to 129 inches—and are useful to measure fabric, building materials, and straight lines, such as room dimensions.

Take a look at your ruler. What do you notice about it? Write down the things that you see on your ruler.________________________________

Do the same with a yardstick or measuring tape.

The Ruler

The ruler is divided by units called inches. There are six inches on this ruler.



Each inch is divided into fractions or parts of the inch. Read the ruler from **left to right** the same as you would a sentence.

- The ruler is divided or marked off in fraction of inches to make it easier to read. Each inch is divided into halves, fourths, eighths, and sixteenths. Notice the marks on your ruler that are different heights. They represent 1/2 in., 1/4 in., 1/8 in. and 1/16 in.
- Can you find each half inch mark? A half inch is one half of an inch. There are two one half inches in one inch.

Now that you've become familiar with the ruler, measure objects around you such as a piece of paper or a book. Bring in objects to class to practice measuring with the ruler, yardstick, or measuring tape. Keep track of what you measure and record the measurements. Work with your math partner or your math team.

Activity: Measure the following:

shoe ____________________

paper clip ____________________

pencil ____________________

table or desk ____________________

Now find other objects to measure. Record your findings.

Object	Measurement

You need to know how to convert inches to feet; feet to inches, yards, or miles; and yards to miles. You can learn how to change **smaller units** of measurement such as **inches** into **larger units** such as **feet**. Likewise you can learn to change larger units into a smaller units. Later you will be able to use similar formulas to convert weight and liquid measurements.

Converting Measurements of Length

First determine how many smaller units (inches) are one unit of the larger unit (feet). There are 12 inches (smaller unit) in 1 foot (larger unit).

- **When converting inches to feet, the smaller unit is the inch. The larger unit is the foot.**

Next divide the number of smaller units you have, by the number of the smaller units in the larger unit.

Example: Change 48 inches into feet.

Step 1: There are 12 in. in a foot

Step 2: You have 48 inches so you divide the 48 inches by the 12 inches in a foot.

Answer: 48 in. ÷ 12 in. = 4 ft.
48 in. = 4 ft.

Another example: Change 67 inches to feet.

Step 1: Determine how many smaller units are the larger unit.
There are ________ inches in **one foot**.

Step 2: 67 in. ÷ 12 in. = 5 ft. 7 in.
When you divided, you saw that **12** does not divide into **67** equally. You had a remainder of **7** which represents the inches you have left over that do not equal another foot. You had $^{7}/_{12}$ of a foot left over. It is commonly written as **5 ft. 7 in.**

Practice: Convert the lengths of inches below to feet. Remember, your remainders are written as inches.

Example: 42 in. = 3 ft. 6 in. 42 divided by 12 equals 3 ft. and a remainder of 6 inches.

1. 24 in. ______________________

2. 17 in. ______________________

3. 49 in. ______________________

4. 56 in. ______________________

5. 124 in. ______________________

- **These steps work to convert all units of measurement. You can also do the same with yards and miles.**

Practice:

Using the chart at the beginning of the chapter, convert the lengths of feet below into their **largest** unit of measurement. It could be yards or it could be miles. Don't forget to write any remainders as feet.

Example: Convert 48 ft. into yards.

First: Determine the smaller unit — **feet**.

How many feet in each yard? — **3**

Then: Divide the total number of feet (48) by the number of feet in a yard (3): 48 ft. ÷ 3 ft. = 16 yds.

1. 14 ft. 4 yd. 2 ft.
2. 72 ft. ____________________
3. 5,759 ft. ____________________
4. 9 ft. ____________________
5. 3 ft. ____________________

You can also convert larger units into smaller units.

- **Feet can be converted into inches;**
- **Yards can be converted into feet or inches**
- **Miles can be converted into yards, feet, or inches.**

Example: Convert 18 feet into inches.

Step 1: 1 ft. = 12 in.

Step 2: 18 ft. x 12 in. = 216 in.

Answer: 18 ft. = 216 in.

Another example: Convert 9 ft. into inches.

Step 1: Using the chart on page 104, determine how many smaller units are in the larger unit.

There are _______ inches in **one foot**.

Step 2: **Multiply** the number of larger units (9) times the number of the smaller units in each of the larger units (12). **Answer**:

9 ft. x 12 in. = 108 inches.

Activity: Converting to Inches

How tall are you?____________ Convert your height into inches.

Example: Tamika's height is **5 ft. 3 in.**
5 ft. x 12 in. = 60 in.
Add the remaining **3 in.**
60 in. + 3 in. = 63 in.
Tamika is **63 in.** tall.

Ask your math partner, class members, family members, and friends their height and convert them to inches.

Name	Height	Inches
Jenny	5 ft. 8 in.	68 in.

Measurement of Weight

Standard Units of Weight

Unit	Abbre-viation	Description
ounce (lb.)	oz.	16 oz. = 1 pound
pound	lb.	1 lb. = 16 oz.
ton	t	1 t = 2,000 lb.

Weight is the measurement of how heavy an object is. The basic unit of measurement in weight is the **pound** which is divided into **ounces**. The largest unit of measurement is a **ton**.

How much do you think you weigh?____________________

How much do you think you weighed when you were born?______________

How about your son or daughter or a family member?________________

Adults measure their weight in pounds. When babies are born, they are weighed in pounds and ounces. You might say, "Ray was a big baby — he weighed 9 lbs. 5 oz.!"

As you see from the chart, **16 ounces (oz.)** is equal to **1 pound (lb.)**. (The ounces in a pound are not the same ounces used to measure liquids.) There are **2,000 pounds** in a **ton.** A car weighs about **1 ton (t)**. Become familiar with the abbreviations. (The abbreviation for **ton** is a small letter "**t**" with no period.)

- Picture familiar objects in your mind and think about how much they weigh. For example, how much meat do you buy to make a meat loaf? Many meat and grocery items are weighed in pounds and ounces.

  How much do bigger objects weigh? Your car? A ship? An elephant? Big objects such as these are weighed in **tons (t)**.

A. With your math partner or team, think of other things that are weighed in **pounds.** Record your answers. *Examples*: flour, sugar

1.____________________ 4.____________________

2.____________________ 5.____________________

3.____________________ 6.____________________

B. How about **ounces**? Again discuss with your math partner or team and record your answers. *Example*: spices, cheese

1.____________________ 4.____________________

2.____________________ 5.____________________

3.____________________ 6.____________________

Converting Measurements of Weight

Converting one weight to another is similar to converting measurement of lengths. Use the same steps.

First determine how many smaller units (**ounces**) make up the larger unit (**pounds**). There are **16** ounces (smaller unit) in **1** pound (larger unit).

Next divide the number of smaller units (**ounces**) by the number of smaller units in each larger unit.

- **Example:** Convert 48 ounces = ________pounds.

  Step 1: 16 oz. = 1 pound

  Step 2: 48 oz. ÷ 16 oz. = 3 lb.

  Answer: 48 oz. = 3 lb.

- **Another example:**

  82 ounces = ______________ pounds.

  Step 1: Using the chart on page 111, determine how many smaller units are in the larger unit. There are __________ **ounces in 1 pound.**

  Step 2: 82 oz. ÷ 16 oz. = 5 lbs. 2 oz.
  When you divide, you realize that **16** does not divide into **82** equally. You have a remainder of **2** which represents the ounces left over that do not equal another pound.

  Answer: **5 lb. 2 oz.**

- You can change **pounds to tons** the same way.
- 2,000 pounds equal 1 ton.

Practice: Change each weight. Don't forget to write any remainders as pounds or ounces.

Example: 32 oz. = 2 lb. 16 divided into 32 equals 2 lb.

1. 24 oz. = ________ lb. ________ oz.
2. 80 oz. = ________ lb. ________ oz.
3. 3,150 lb.= ________ t ________ lb.
4. 23 oz. = ________ lb. ________ oz.
5. 2,145 lb. = ________ t ________ lb.

- **You can also change larger units (pounds and tons) to smaller units (ounces and pounds).**

  Pounds can be changed to ounces.

  Tons can be changed to pounds and ounces.

Example: Convert 22 pounds =_______ ounces.

Step 1: 1 lb. = 16 oz.

Step 2: 22 lb. x 16 oz. = 352 oz.

Answer: 22 lb. = 352 oz.

Another example: 3 Tons = _________ pounds.

Step 1: Determine how many smaller units are in the larger unit. There are ______ pounds in **one ton**.

Step 2: **Multiply** the number of larger units (3 t) times the number in the smaller unit (2,000 lb. = 1 t)

Answer: 3 t x 2,000 lb. = 6,000 lb.

Change each weight. Don't forget to write any remainders as pounds or ounces.

Practice:

Example: 6 lb. = 96 oz. 6 lb. multiplied by 16 oz. equals 96 oz.

1. 14 lb. = __________oz.
2. 3 t 325 lb. = _________lb.
3. 150 lb.= _________oz.
4. 6 t = _______lb.
5. 45 lb. = ______oz.

Measurement of Liquids

Standard Units of Liquid

Unit	Abbreviation	Description
ounce	oz.	8 oz. = 1 cup (c.)
pint	pt.	1 pt. = 2 c. = 16 oz.
quart	qt.	1 qt. = 2 pt. = 32 oz.
gallon	gal.	1 gal. = 4 qt. = 128 oz.

The units that are used to measure capacity are **fluid ounces***, **cups, pints, quarts,** and **gallons.**

- **Remember, a *fluid* ounce is different than an ounce in weight measurements.**

  Fluid ounces measure *liquid* and ounces measure the solid weight of an object.

How many cups of soda do you think you drink in a week?________________

Do you buy milk in gallons, quarts, or pints? ________________

Have you ever mixed baby formula measuring fluid ounces?________________

- **8 fluid ounces (oz.)** is equal to **1 cup (c.)**. There are **2 cups** in a **pint.** A small container of milk or ice tea is often a **pint**.

- Collect containers around your home that milk or other liquids come in and check the liquid measurements. Soda cans are usually 12 fl. oz. That 's equal to 1 1/2 cups of soda or 1 cup and 4 ounces. Since 8 ounces is one cup, 4 ounces is one half of a cup.

A. With your math partner or team, discuss what other things that are measured in ounces, cups, pints, or quarts. **Example:** ice cream, pints, and quarts. Record your answers.

1.______________________________ 4.______________________________

2.______________________________ 5.______________________________

3.______________________________ 6.______________________________

B. How about **gallons? Example:** gasoline. Again discuss with your math partner or team and record your answers.

1.______________________________ 4.______________________________

2.______________________________ 5.______________________________

3.______________________________ 6.______________________________

- Using the table on page 116, you should be able to convert the different measures for liquid in the same way that you did for lengths and weights.

- Do you ever wonder how many gallons of water you use every day?

  With your math partner or math team, investigate at the library how much water the average person in your town uses. Compare this to other cities and countries.

Converting Smaller Units of Liquid Measure to Larger Units

First determine how many smaller units (**fluid ounces**) make up the larger unit (**cup**). There are **8** ounces (smaller unit) in **1** cup (larger unit).

Next divide the number of smaller units (**fluid ounces**) by the number of smaller units in the larger unit (8 oz.).

- **Example: Converting fluid ounces to cups**

Problem: Convert 24 fl. oz. = _________cups

Step 1: 8 fl. oz. = 1 cup
Step 2: 24 fl. oz. ÷ 8 fl. oz. = 3 cups

Answer: **24 fl. oz. = 3 cups**

- **Another example: Converting pints to quarts**

Problem: 17 cups = __________ pints.

Step 1: Determine how many smaller units (cups) are in the larger unit (pints).

There are ______ cups in **1 pint**.

Step 2: 17 c. ÷ 2 c. = 2 pt. 1 c.

When you divided you became aware that **2** does not divide into **17** equally. You had a remainder of **1** which represents the number of **cups** left over that do not equal another pint. Write it as **8 pt. 1 c.**

- **You can change quarts to gallons the same way.**

Practice

Change each liquid measure to its larger unit. Don't forget to write any remainders as their measurements of fluid ounces, cups, pints, quarts, or gallons.

Example: 6 qt. = 1 gal. 2 qt. 4 qt. divided into 6 qt. equals 1 gal. 2 qt.

1. 24 oz. = ______ c.
2. 78 qt. = ______ gal. ______ qt.
3. 92 pt.= ______ gal. ______ qt.
4. 8 pt. = ______ gal.
5. 9 qt. = ______ gal. ______ qt.

- **You can also change larger units (cups, pints, quarts, and gallons) to smaller units (fluid ounces, cups, pints, and quarts).**

Example:

Problem: 20 gallons =____80 quarts

Step 1: 1 gal. = 4 qt.
Step 2: 20 x 4 = _____80 quarts

Answer: **20 gal. = 80 quarts.**

Another example:

Problem: 5 gallons = _____ qt.

Step 1: Determine how many smaller units are in the larger unit.

There are _______ **quarts in one gallon.**
Step 2: **Multiply** the number of larger units (5 gal.) times the number in the smaller unit (4 qt. = 1 gal.)

Answer: 5 gal. x 4 qt. =20 qt.

Practice:

Change each measurement.

Example: 6 qt. = 96 oz. 6 qt. multiplied by 2 pt. equals 96 oz.

1. 17 gal. = _______________qt.

2. 3 qt. = _______________pt.

3. 15 pt. = _______________c.

4. 6 c. = _______________oz.

5. 42 gal. =________________qt.

Activity: Word Problems

1. Tanya bought 3 gallons of milk for her son's birthday party. How many cups will she have?____

2. Matthew needs to serve punch at the birthday party. He needs to know which measurement is larger: 8 pints or 3 quarts?________________
How much larger?________________

3. To make his punch, Matthew needs to know that 1 quart is equal to ___________pints, _________cups, and ______________ ounces. He needs to have 23 ounces of orange juice for the punch. How many cups is that? ___________How many pints?________________

Retelling the Story: Graphs and Charts

- What Do You Know?
- What are Graphs?
- Pictographs
- Circle or Pie Graphs
- Bar Graphs
- Line Graphs
- What are Charts?

Retelling the Story: Charts and Graphs

What Do You Know?

Answer the questions below. They will give you an idea of what you already know about charts and graphs. Check to see if your answers make sense.

1. Can you think of any charts that you now use? (for example: telephone bills, television listings) ______________________

   ____

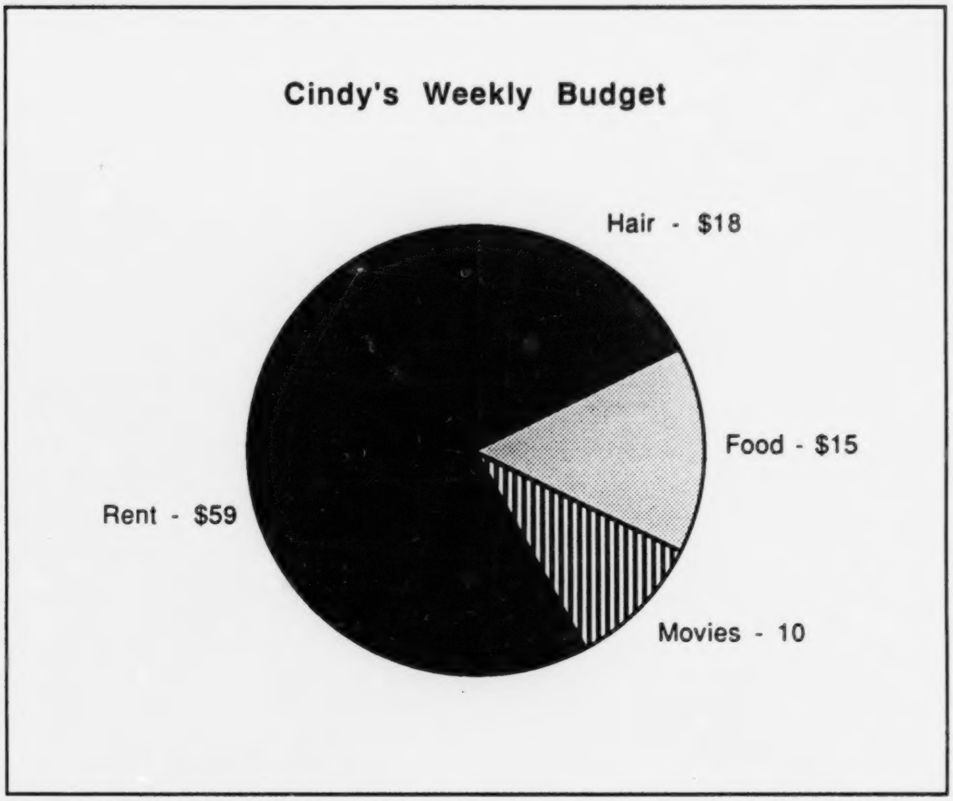
2. Have you ever created a chart or graph? ____________What was it for?____

3. What information would you need to create a growth chart for your children or a friend's child?______________________

   ____

•Please go to the pie graph on the next page.

Use the chart below to answer questions 4a., 4b., and 4c.



4a. How much does Cindy spend on food? ________ If this is what she spends on food for one year?______________________________

4b. Does Cindy spend more on her hair weekly or on her rent?________

4c. How much does Cindy budget for the entire week?________________

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What are Graphs?

Numerical data are a collection of numbers that provide specific information. Numerical data are often represented in a visual or picture form called a **graph**. A graph presents readers with a picture that makes it easier to understand and interpret data.

Activity: Reading Graphs

Note: You will need a newspaper or magazine for this activity. Look through a newspaper or magazine and find a graph.

1. What do you notice about the graph? ______________________

   ____

2. What is the title of the graph?__________________________

3. What is the purpose of the graph?________________________

4. What numerical information does it provide? ______________

   ____

Pictographs

One way to learn about pictographs is to create one of your own.

1. On the blackboard or on a large piece of paper, write each class member's name along the left side. You are going to make a pictograph of the number of children that each class member has. Let's call the chart "**Our Children**." (If you like, you can pick other information to chart, such as height or weight.) Now your chart has a title. It should look something like this:

OUR CHILDREN

Susan

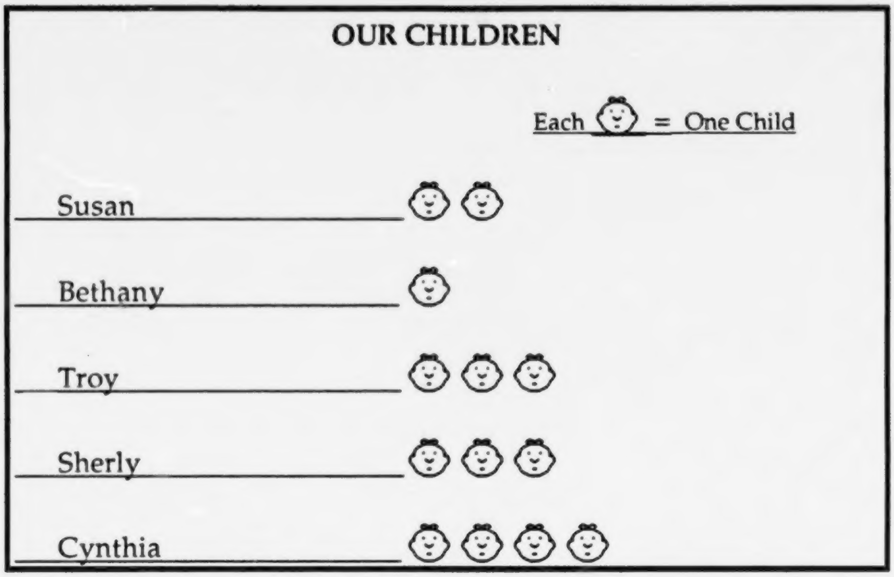
Bethany

Troy

Sherly

Cynthia

2. Now we need to fill in the information. Let's draw a picture to represent each child. Here we will use this picture ☺ to represent each child. Ask each person in the class how many children he or she has. Put the same number of pictures next to his or her name to represent the number of children. Example: Sherly–3 children: ☺ ☺ ☺. The pictograph will look something like this:


OUR CHILDREN

Look at the pictograph. Who has the most children?______ Does Troy have more children than Cynthia?__________________

Now look at the graph that you have created from the information from your class. Using complete sentences, write down, or summarize, the information provided about your classmates from the pictograph.

1. ____

____

2. ____

____

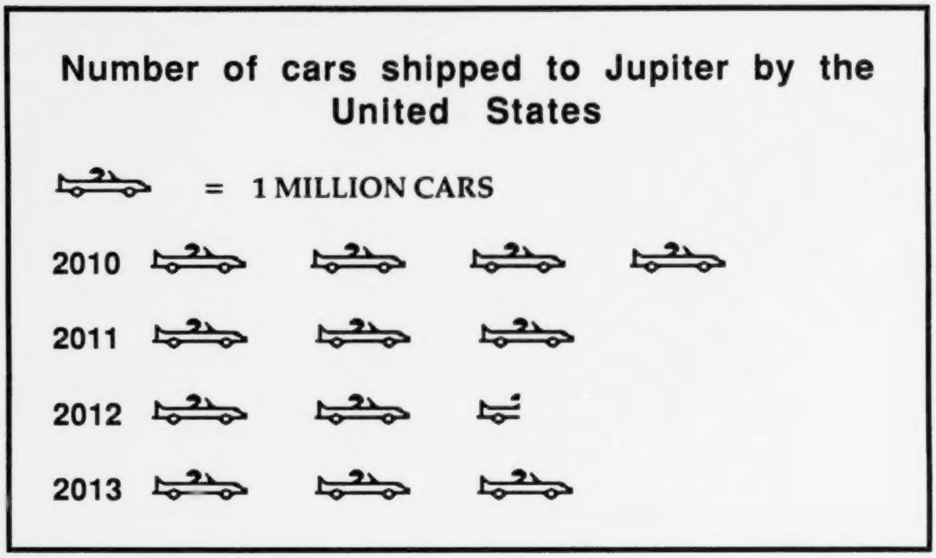
3. ____

____

A **pictograph** is one type of graph. It uses symbols to represent numbers. In the above graph we used ☺ to represent one child. We could have used it to represent more than one child. Some people have many grandchildren. If we were counting grandchildren, we could have used ☺ to represent 5 grandchildren. From the information from the above graph, Susan would have had ☺ ☺, or 10, grandchildren.

Below is another imaginary **pictograph** with information about cars shipped to Jupiter. Each picture of a car represents one million cars.

Interpreting a Pictograph



Can you read the pictograph?

1. How many cars got shipped to Jupiter in 2010?__________________

2. Were more cars shipped to Jupiter in 2013 or 2012?________________

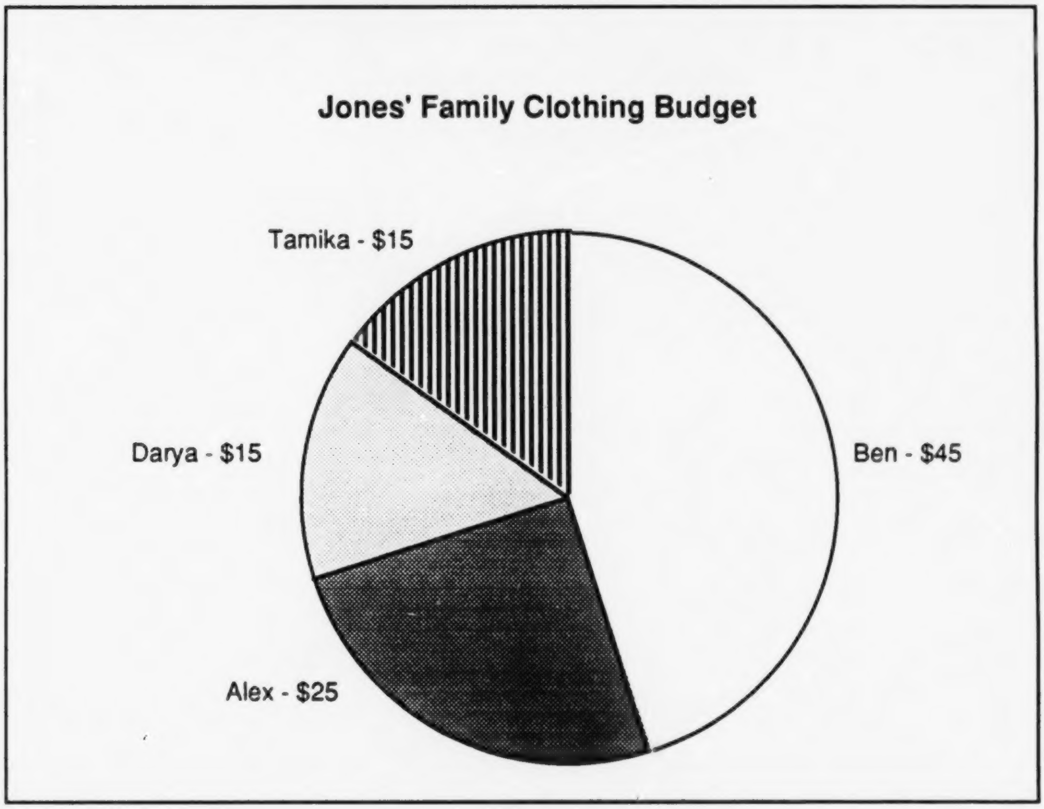
3. Which year were the least number of cars shipped to Jupiter?______

In 2010, there are 4 pictures of cars (🚗). Each picture represents one million cars. Four (4)million cars were shipped to Jupiter in 2010. In 2012, then there were 2 $^1/_2$ million cars shipped. The half of a car represents $^1/_2$ million, or 500,000 cars. In 2011 and 2013, there were 3 million cars shipped.

Circle or Pie Graphs

Another type of graph is called a circle or pie graph. In a pie graph, a circle is divided into pieces and each piece represents a different value. In the chart below, each piece has a dollar value. The whole circle graph is equal to the total of the budget which is $100.

- The circle or pie graph below was created by a class to show one student's clothes budget for her four children. The graph shows that she has **$25.00** for baby Alex, **$15.00** for Tamika, **$45.00** for Ben, and **$15.00** for Darya. Her total budget is **$100.00**.



Jones' Family Clothing Budget

Questions: Answer the questions below using the graph from the previous page.

1. How much more money is budgeted for Ben than Darya?__________

____

2. Will there be any money left over from the $100 budget?_____

3. Is more money being budgeted for Alex or Tamika?_________

Activity: Creating a Circle or Pie Graph

Create your own pie or circle graph using numerical information that you have collected. It can be created to reflect any numerical information that you want—for example, a monthly or weekly budgets or less important information such as how many pairs of black, brown, white, and beige shoes you own.

Step 1: Collect the information you are going to put on the graph.

Step 2: Add up the total. Example: Total number of pairs of shoes = 16 pairs.

Step 3: Separate the information into categories. Example: 3 brown pairs of shoes; 5 black pairs of shoes; 6 beige pairs of shoes; 2 white pairs of shoes. Total = 16 pairs of shoes.

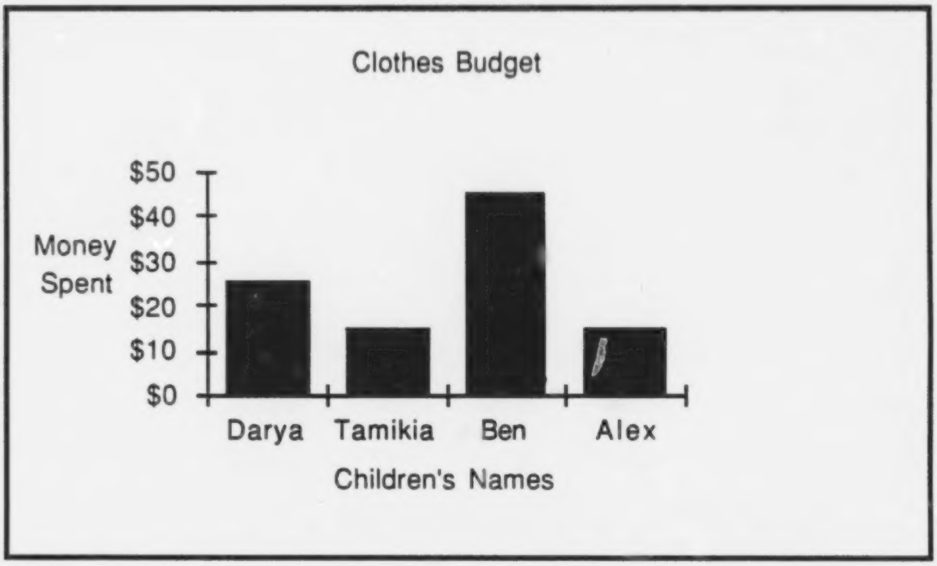
Step 4: Draw a circle—either free hand or using a pattern— and divide the circle as closely as you can to represent the different segments or "slices" of the pie chart.

If we were to chart the shoes, for example, we would need four different segments, the largest representing 6 beige pairs of shoes and the smallest "slice" representing 2 white pairs of shoes.

- When you have finished drawing your graph, work either as math teams or partners, and write about what you decided to graph and how you did it. Pretend you have to explain it to another class.

Bar Graphs

Bar graphs are graphs with bars— running either up and down or left to right—which represent numerical information. Below is a **bar graph** which uses the same numerical information about the Jones family clothes budget that we saw in the pie chart.



Questions:

1. How much does the bar graph show budgeted for Alex?____________
2. How much is budgeted for Ben?______________________________
3. Is more money being budgeted for Darya or Alex?____________
4. Is this bar graph easier or harder than the pie graph to read ?________

   Why ?____

5. Write a sentence about the information that is given in the bar graph.

Activity: Creating a Bar Graph

Work together as a class or in math teams to create our own bar graph.

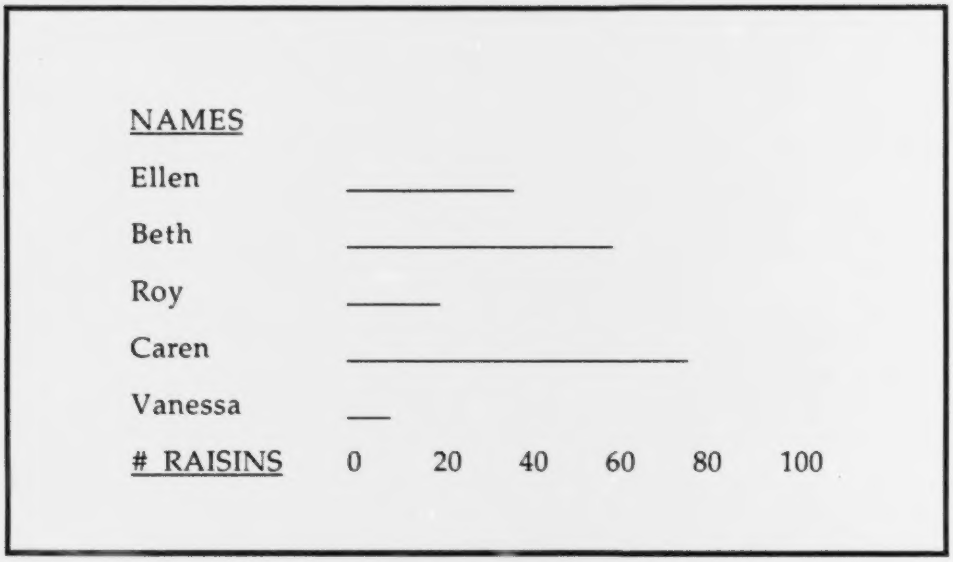
You will need:
one snack-sized box of raisins for each class member
a volunteer to write information on the blackboard or paper

1. The volunteer at the board will be called the Chart Maker. Class members will supply the Chart Maker with the necessary information to create a bar graph.
2. The Chart Maker writes every class member's or team member's name on the board in the column on the left side and numbers along the bottom of the chart to represent numbers of raisins.

NAMES						
Ellen						
Beth						
Roy						
Caren						
Vanessa						
# RAISINS	0	20	40	60	80	100

3. Each class member will **estimate** or guess how many raisins are in **one** snack-size raisin box. The Chart Maker will draw a line next to

each class member's name representing each person's estimate. It should look something like this:

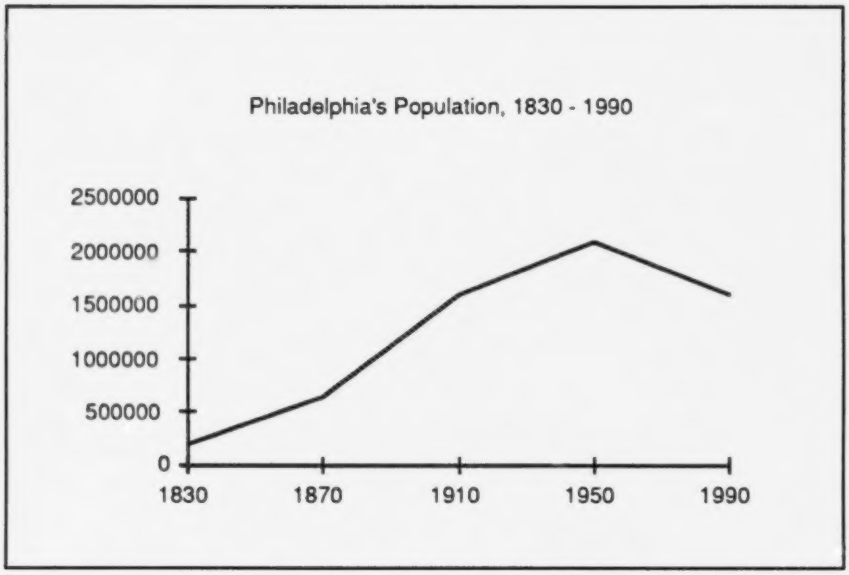


4. The Chart Maker should thicken the lines to make bars as is seen in the Clothes Budget bar graph.
5. Someone should now count the raisins and check to see who had the estimate closest to the actual number of raisins in a box.
6. What other type of numerical information can you use to make a **bar graph**?

Line Graphs

Line graphs use one or more lines to show a trend or a change in values—for example, companies often use line graphs in quarterly financial reports to show profits and losses. Often you can find line graphs on the stock market pages of the newspaper or in a business magazine.

Below is a line graph with information about the population of Philadelphia between 1830-1990.[5] By looking at the graph, we can quickly see that the population was much lower in 1830 than in 1870 rising steadily until 1950 when it started to drop. After looking at the line graph, answer the questions that follow.



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[4] Finkel, Kenneth, Editor. *Philadelphia Almanac and Citizens' Manual, 1994.* Philadelphia, PA: The Library Company. 1994.

From the graph, can you estimate approximately how many people lived in Philadelphia in 1870?____________________

2. In what year did the population peak?_____________________
3. Can you estimate what the population in 1990 was?_________
4. From the information in the chart, and your own knowledge, do you think that the population is going to go up or down in Philadelphia in the next 40 years? Discuss your answer with other class members.

- As a class or in teams, discuss line graphs. Write down questions to ask each other.
- In a discussion, compare and contrast line graphs to pictographs, circle, and bar graphs.
- Try making a line graph by collecting data from your family such as how much sleep family members get by age. There are many things in our lives that have information that we can use to create a graph.

What are Charts?

Charts present information in columns and rows. A menu is a good example of a chart; it lists items in one column and the price in a corresponding column. To figure out the price of a specific food item, look along the row of the food item to the column with the price list. A television schedule is another example of a chart.

- **Charts, like graphs, have titles.**
- **Charts can also contain tables with words and numbers written in rows and columns. Bus and train schedules are examples of tables.**

Reading Charts

A television schedule usually looks something like this:

Morning Television Schedule

MORNING SHOWS	10:00	10:30	11:00	11:30	12:00
Monday	Kathy & Regis Talk		Cook It!	One Life	Spanish
Tuesday	Kathy & Regis Talk		Italian	How To!	Star Trek
Wednesday	Kathy & Regis Talk		Movie		

Charts have columns which are read up and down and rows which are read across, from left to right.

In this chart, the days are listed in the left column under the column heading, "Morning Shows." The remainder of the columns present the shows scheduled by the time they begin. The rows present the scheduled shows by days of the week.

The TV schedule can be read across from left to right or up and down. For example, you can read across to see all of the shows on Monday morning, or you can pick a time—say 11:30 — and see all of the shows at that time for the week.

Questions:

1. What show is on at 10:00 A.M. on Monday?____________Is it on any other day?______________If so, when?_________________
2. When is the movie on?____________________________________
3. Wanda gets home at 11:00 each day. She watches a half hour of TV. What show does she watch on Tuesday?_____________________
4. List two shows that are on Wednesdays._____________________

   ____

   - **Work with your math partner or team and list other examples of charts that you use or see in your everyday life.**

_____________________________ _____________________________

_____________________________ _____________________________

Activity: Creating a Chart

Class members can do this as a class or in math teams.

1. On the blackboard or posterboard, write these four column headings along a top row:

   Class Members **Sisters** **Brothers** **Birth Order**

2. List all of the class members' in the left hand column headed, "Class Members."

3. Ask the class members to write down the number of brothers and sisters they have and their own birth order in the family. **Example**: Sandy has three sisters and two brothers and she is the oldest child in the family.

4. Remember that charts have titles. Choose a title for this chart.

The chart should look something like this:

GED Morning Class • Siblings & Birth Order

Class Members	Sisters	Brothers	Birth Order
Sandy	3	2	oldest
Ron	2	6	5th born
Tricia	1	0	only child
Anthony	8	1	3rd born
Mia	0	4	youngest

- Write a short paragraph describing some of the information learned from the chart that the class or your math team has created.

  - What other information could be used to create a chart?

Math Games

- Why Play?
- Mental M-A-T-H-O
- Roll 'Em and Weep
- The Fraction Dice Game
- FUNction Frenzy Dice Game
- The Problem Game
- The Case of the Disappearing Digits
- 21, Oh No!
- Math Mystery

Math Games

Why Play?

You may ask yourself or members of your math team, "Why play math games?" If you had to explain this to another class or other learners, what are some of the reasons that you can think of? Some learners found that playing math games aided them in understanding some mathematical concepts and helped them learn computations that they were unfamiliar with. Write your reasons in complete sentences.

____

____

____

____

____

MENTAL MATHO

Materials needed: MATHO Card; Caller's Sheet a watch with a second hand.
Number of Players: 2 or more; 1 caller.
Time: 5 seconds per problem or class choice of time limit.

- MATHO is a game similar to BINGO.

Object: To develop mental computation skills and active listening skills.

How to make Caller Sheets and MATHO Game Cards:

1. Players will first create Caller Sheets and MATHO Game Cards.
2. Each player gets a blank MATHO Caller Sheet and records 24 problems with their correct solutions, one on each blank line. (Line 3 under letter "T" is a free space.) The problem can involve addition, subtraction, multiplication, and/or division depending on the players' skill levels. This should be decided by the class.
3. Next, each player gets a blank MATHO Game Card and copies the answers to the problems on the Caller Sheet to the boxes in the corresponding columns on the Game Card. However, the answers are not copied in the order 1- 5 in which they appear on the Caller Sheet.

For example:

Caller Sheet	Game Card
M	**M**
1. 2 + 3 = 5	**16**
2. 7 + 9 = 16	**1**
3. 0 + 1 = 1	**23**
4. 23 + 2 = 25	**5**
5. 17 + 6 = 23	**25**

The Caller Sheet and Game Cards are collected and photocopied for future use.

Rules of the Game:

1. To play MATHO, one set (Caller Sheet and Game Card) are selected and copies of the card are made for each player.

2. The Caller calls out a new math combination and row every 5 seconds by calling out a row, such as **"M"** and the problem from that row, such as **"2 + 3."** Beginning math learners can decide to have the caller extend this time limit. The Caller must check off what has been called. **The Caller reads only the problem, not the answer.**

3. Players cannot write the combinations down on their paper but must listen for the problem and do Mental Math!

4. Players cannot ask for a repeat of a combination just as in a regular BINGO Game.

5. Every combination is equal to a number on the player's MATHO Game Card. As a combination such as 12 + 13 is called out, the player looks for the answer - 25 - on the card and marks the 25 square.

How To Win:

1. Players can win, as in regular BINGO, by filling a row or column, vertically, horizontally, diagonally, or by getting all four corners. Some of the more experienced BINGO players can share their BINGO scoring knowledge with other players.
2. When a player (or players) has a winning combination, he or she yells MATHO! The Caller checks the player's card for accuracy. If the player has MATHO, he or she is the winner and a new game begins, otherwise, play continues.
3. **Round-Robin** is another way to score MATHO by going all the way around the edge of the card.

MATHO CALLER SHEET

CALLER SHEET

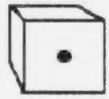
M	A	T	H	O
1. ________	1. ________	1. ________	1. ________	1. ________
2. ________	2. ________	2. ________	2. ________	2. ________
3. ________	3. ________	3 FREE	3. ________	3. ________
4. ________	4. ________	4. ________	4. ________	4. ________
5. ________	5. ________	5. ________	5. ________	5. ________

MATHO GAME CARD

M - A - T - H - O

		FREE		

Roll 'Em and Weep



Materials needed: **Dice, paper and pencil for score keeping.**
Number of Players: **2 or more.**
Time: **No limit.**

Object: **To be the first player to roll the dice and get to 50 by adding or subtracting.**

1. Two or more players can play. One class believes that the game plays best with four players. Play with 2 dice.

   - No touching someone else's dice.
   - If you roll out of turn you lose your roll.
   - Decide on which player will keep score.
   - Start over after someone wins. The winner keeps score for the next round.

2. Each player takes a turn and rolls the dice and decides whether to add or subtract the numbers rolled.

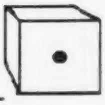
   Example: Player number one rolls ⚅ and ⚄, decides to add and gets the score 11. The next player might roll ⚃ and ⚀, add and get 5.

3. As you get near to 50, you will need to subtract to help you reach exactly 50. Look at the examples below:

Two ways to subtract: Example

a. Roll a six and a three, say 6-3=3 and then subtract 3 from your current total score **or**

b. Add the two dice together and subtract that number from your score. 6 + 3 = 9 Subtract 9 from your current total score.

The Fraction Dice Game 

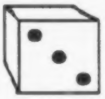
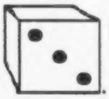
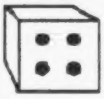
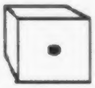
Adding and Subtracting Fractions

Materials needed:	Dice, paper and pencil for score keeping. Cover the sides marked 5 and 6 on the dice. Play with just the numbers 1, 2, 3, and 4. (You can play with numbers 1 through 6 but the game takes a very long time.)
Number of Players:	2 and up.
Time:	No limit.

Object: To be the first player to get to a score of 5 by creating and either adding or subtracting fractions.

1. Two or more players can play. Play with 2 dice.
   - No touching someone else's die.
   - If you roll out of turn you lose your roll.
   - Each player keeps his or her own score.
   - Start over after someone wins.

2. Each player takes a turn and rolls the dice.

   Example: Player number one rolls  and . Player number one has $^{3}/_{3}$ or 1. The next player rolls  and  and will either have a score of $^{1}/_{4}$ or $^{4}/_{1}$ (4). Each player decides what his or her fraction will be on each roll.

3. As you get closer to 5, you can start to subtract to help you reach exactly 5. Look at the examples below:

Player 1

Roll	Number	Operation	Total
3,3	$^{3}/_{3}$		1
1,3	$^{3}/_{1}$	+	4
3,4	$^{3}/_{4}$	+	$4\,^{3}/_{4}$
2,4	$^{2}/_{4}$	-	$4\,^{1}/_{4}$

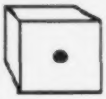
Player 2

Roll	Number	Operation	Total
4,1	$^{4}/_{1}$		4
2,4	$^{2}/_{4}$	+	$4\,^{2}/_{4}$
1,3	$^{1}/_{3}$	+	$4\,^{10}/_{12}$
4,4	$^{4}/_{4}$	-	$3\,^{10}/_{12}$

Notice that in roll #3, player 2 had to change fourths and thirds to the common denominator of twelfths. Also, in roll #4, both players had to subtract to keep from going over 5.

4. The game is over when one player gets **exactly** 5.

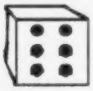
Make up new rules as you come across them!

FUNction Frenzy Dice Game 

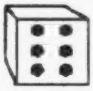
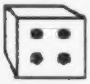
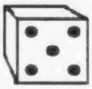
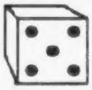
Adding, Subtracting, and Multiplying Whole Numbers

Materials needed:	**Die, paper and pencil for score keeping.**
Number of Players:	**2 and up.**
Time:	**No limit.**

Object: **To be the first player to get to 50 by adding, subtracting or multiplying the number on the die. If you go over 50, you're out!**

1. Two or more players can play. Play with 1 die. 
   - No touching someone else's die.
   - If you roll out of turn you lose your roll.
   - Each player keeps his or her own score.
   - Start over after someone wins.

2. Players take turns and roll the die. **Before rolling**, the player announces whether he will add, subtract or multiply his roll with his total.

Example: Player number one rolls  so that is his score. Player two might roll . Player one says he will multiply his roll by his total. He rolls  so his score is 30. Player two announces he will add his roll and also rolls  so his total is 9.

3. Players have to be careful to try to get 50 without going over. As they get close to 50, they need to think of the odds of getting the number they need on the next role as opposed to the odds of going over 50. For example, if a player has 44, there is one chance in six of getting the needed number, 6, to make 50. There is no chance of getting more than 6 (a die is numbered 1 through 6) so the player should definitely add. However, if the player has 48, there is still only one chance of getting exactly 50 (roll a 2), but four chances of going over (roll a 3, 4, 5, or 6). Only a real gambler would add in this situation.

   Complete the table below. Figure out the possibilities of adding a number rolled on one die to a starting total of 44, 45, 46, 47, 48 and 49.

Starting Total	Possibilities for getting 50	Possibilities for staying under 50	Possibilities for going over 50
44	1 (roll a 6)	5 (roll a 1, 2, 3, 4, 5)	0
45	1 (roll a ____)	4 (roll __________)	1 (roll a __________)
46	1 (roll a ____)	___ (roll a __________)	___ (roll a __________)
47	1 (roll a ____)	___ (roll a __________)	___ (roll a __________)
48	1 (roll a 2)	1 (roll a 1)	4 (roll a 3, 4, 5, 6)
49	1 (roll a ____)	___ (roll a __________)	___ (roll a __________)

4. The game is over when one player gets **exactly** 50 or when only one player is left.

   Make up new rules as you come across them!

The Problem Game

Materials needed: **Blackboard, chalk.**
Number of Players: **4—6 per team.**
Time: **Beginning level— no time limit;**
Advanced teams can set their own time.

This game helps learners work in teams as they create their own problems.

Object: Teams try to out fox each other by creating tough problems but ones which are not too difficult for their own team to answer correctly. The first team to answer all of their questions correctly wins!

- Some guidelines need to be agreed upon before the beginning of the game, such as limiting the number of digits in each problem or the math function for the level of the teams.

  Example: Both teams will agree to use numbers with place values no greater than to the hundredths place and only in addition or subtraction. **34.73 + 812.02 = ?**

  This prevents one team that is better in decimals from having an unfair advantage. These guidelines are to be established before each game.

How To Play:

1. The class divides into teams and picks a team name. Someone must volunteer to be the scorekeeper. The scorekeeper cannot play while keeping score.

2. Together the team writes one problem for each member of the opposite team. Each problem is written on a separate piece of paper and numbered starting with 1. The answers to the problems are written on a numbered answer sheet.

   Example:

   If there are 6 team members, Team Applesauce must write 6 different problems on six separate pieces of paper numbered 1 – 6. They number their answer sheet from 1 to 6 and write the answer for each problem beside the appropriate number.

3. The scorekeeper collects the problems and answer sheets, keeping each team from seeing the other team's work. The scorekeeper then uses **Team A**'s problems for **Team B** and **Team B**'s problems for **Team A**.

4. The blackboard is divided in half. As each team member goes to the board in rounds, the scorekeeper gives each one a problem. They put the problem on the board and compute the problem.

Scoring:

5. Team members must solve their problems without help from the rest of the team. Let's say that the first person done is on **Team B**. If the problem was

solved correctly, **Team B** wins **three points**. If **Team A** had the incorrect answer on their answer sheet, **Team B** gets another point. If the **Team B** member gets the problem wrong and **Team A** had the correct answer on their answer sheet, **Team A** gets one point and **Team B** gets none. The Scorekeeper must be able to keep track of this and check answers. Use of a calculator or help from the instructor is acceptable.

6. The team with the most points at the end of the game wins!

THE CASE OF THE DISAPPEARING DIGITS

Materials needed:	**Digit Sheets.**
Number of Players:	**Any number.**
Time:	**Varies, no limit.**

Object: This game can help learners understand the importance of place value and setting up problems. It can also be used with family members.

Rules of the Game:

The rules are simple. Use the attached **missing digit sheet** as an example, but feel free to make up your own! The example is for addition and subtraction but be creative and use your math knowledge to challenge your team when you create a missing digit sheet.

1. Look at the attached sheet. All players should have the same sheet with the same problems.

2. The players need to establish a time limit based on the difficulty of the **missing digit sheet.**

3. A scorekeeper needs to keep track of the time limit and let players know when time is up.

4. Players exchange missing digit sheets and check each other's answers. The player who has finished the most correct answers is the winner.

Disappearing Digits Worksheet

$$\begin{array}{r} 719 \\ -\ 3?4 \\ \hline 335 \end{array} \qquad \begin{array}{r} 2?0 \\ -65 \\ \hline 155 \end{array} \qquad \begin{array}{r} 329 \\ -\ 17? \\ \hline 156 \end{array} \qquad \begin{array}{r} 2?0 \\ -104 \\ \hline 136 \end{array}$$

$$\begin{array}{r} ?21 \\ +214 \\ \hline 335 \end{array} \qquad \begin{array}{r} 6{,}7?9 \\ -\ 3{,}297 \\ \hline 3{,}452 \end{array} \qquad \begin{array}{r} 329 \\ -\ 27? \\ \hline 56 \end{array} \qquad \begin{array}{r} 2?2 \\ -104 \\ \hline 138 \end{array}$$

$$\begin{array}{r} 823 \\ -\ 2?8 \\ \hline 535 \end{array} \qquad \begin{array}{r} 2?4 \\ -89 \\ \hline 155 \end{array} \qquad \begin{array}{r} 329 \\ -\ 28? \\ \hline 43 \end{array} \qquad \begin{array}{r} 3?2 \\ +104 \\ \hline 496 \end{array}$$

$$\begin{array}{r} 477 \\ -???\\ \hline 239 \end{array} \qquad \begin{array}{r} ??? \\ -165 \\ \hline 137 \end{array} \qquad \begin{array}{r} 5?6 \\ -?2? \\ \hline 248 \end{array} \qquad \begin{array}{r} 2?0 \\ +?89 \\ \hline 57? \end{array}$$

21 *Oh No*

Materials needed: None
Number of Players: 2 or more.
Time: Varies, no limit.

Object: This is a counting game for two players. Try to outsmart your opponent! Each player tries to be the first to reach the count of 21.

How To Play:

1. Players must decide who will go first.
2. During each turn, each player can either count one number or two numbers.

Example 1:		**Example 2:**		**Example 3:**	
Player # 1:	1	Player # 1:	1, 2	Player # 1:	1
Player # 2:	2	Player # 2:	3	Player # 2:	2, 3
Player # 1:	3	Player # 1:	4	Player # 1:	4, 5
Player # 2:	4	Player # 2:	5, 6	Player # 2:	6, 7

TIP 1: Notice when you can tell who is going to get to say 21. Once you can tell, consider this a key number. Now notice when you can tell who is going to get to say that key number. Consider this your new key number and continue working backwards. It might help to write down the key numbers and see what they have in common.

TIP 2: Think of who should go first.

Math Mystery

Materials needed: None.
Number of Players: 2 or more.
Time: Varies, no limit.

Object: This is a guessing game similar to other games you may have played. The main difference is that all clues involve numbers.

How to Play:

1. One player selects an item. He tells the other players whether it is animal, vegetable, or mineral. A discussion of what belongs to each group might avoid later confusion or disagreement. For example, it is important to note that for this game, humans are considered animals.

2. The other players take turns asking questions about the item. Each question must involve a number. Also, answers can only be "yes" or "no." For example, if the first player says "I'm thinking of something that is an animal," questioning might proceed as follows:

Does it have 4 legs?	No
Does it have 2 legs?	Yes
Is its temperature about 98.6^{0}?	Yes
Was it born before 1950?	Yes
Does it have 2 X chromosomes?	No

Note that every question has a number in it. Questions which do not have a number in them cannot be answered.

3. Play continues until someone guesses the item correctly. If a player attempts a guess and is incorrect, he or she is out.
4. The player who guesses correctly gets to choose the next item.

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Math Literacy

Teacher's Guide

Section 353, Project #098-4020

by

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Curriculum Developer

July 1994

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The activity that is the subject of this report was supported in part by the U.S. Department of Education. However, the opinions expressed herein do not necessarily reflect the position or policy of the U.S. Department of Education or the Pennsylvania Department of Education, and no official endorsement should be inferred.

Math Literacy
Teacher's Guide

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Acknowledgments

I am grateful to the following teachers and their students, at the Center for Literacy, for discussing teaching practices and learning styles; piloting materials and offering suggestions for revisions; and supporting the project's year-long development. Their voices and encouragement guided me in writing these materials:

Elizabeth Dougherty, instructor, Parent Child Center class;
Faith Green, instructor, Hill School Even Start class;
Sandy Harrill, instructor, West Philadelphia community class;
Wendy Lovell, instructor, Pastorius School Even Start class;
Jane McGovern, instructor, Broad and Morris community class;
Anita Pomerance, instructor, Stearne School Head Start class; and
Monty Wilson, instructor, Douglass School Even Start class.

Special thanks to the Healthy Start class, Kingsessing Library, for field testing the materials for each chapter and for telling their teacher that they "love math."

Additional thanks to Rose Brandt, CFL's Director of Educational Planning, for her help in editing and shaping this manual and Yvette Walls, CFL educator, who read several drafts.

I am also indebted to Iddo Gal of the National Center on Adult Literacy (NCAL) for his review of this material and for his insightful discussions of teaching practices of numeracy. Special thanks to Lynda Ginsburg of NCAL for her generous encouragement and support. I would also like to thank the Inquiry Group on Adult Numeracy (sponsored by NCAL and the University of Pennsylvania and led by Iddo Gal and Lynda Ginzberg) of which I was gratefully a member: Richard Drucker, Community Occupational Readiness and Placement Program; Frederick Leinhauser, Adult Education, Temple University; Lynne Mikuliak, Community Women's Educational Project; and Christa Snow, Nationalities Service Center.

I would also like to thank Shelley Bourgeois, Catherine Coleman, Martha Merson, and Mary Jane Schmidt of the Massachusetts ABE Math Standards Inquiry Project for their interest and ideas.

Ben Burenstein of Drexel University's Office of Computer Services deserves special thanks for sharing his computer expertise.

The development of these materials was supported in part by the U.S. Department of Education and the Pennsylvania Department of Education, Division of Adult Basic and Literacy Education Programs.

To the Teacher

Math literacy, like reading and writing literacy, is more than a set of skills. It involves being able to use and interpret numbers in the real world of adult math and to meet one's personal goals.

The availability of calculators and computers in today's world makes the need for skills in performing basic operations less important. There is an increased need for individuals to understand operations and relationships of numbers and be able to manipulate them with ease. This understanding enhances math students' abilities to be active citizens, supportive parents, and successful employees as they make sense of their world.

Hopefully, *Math Literacy* will lay the ground work for student's to begin thinking about the world mathematically, viewing math differently, and developing a math sense which will continue to grow as they pursue an understanding of math through formal study or simply through approaching numbers from a new and different viewpoint.

Math Literacy was written to address some of the needs in the field of adult literacy and numeracy. It offers students an introduction to math that will provide a foundation for further study of mathematics. The curriculum also provides practice with reading, writing, critical thinking, and discussion of math.

The materials are designed to provide math learner's and other class members time for reflection and discussion of materials; activities for math teams and math partners; individual and group writing; game playing and of course, practice focusing on understanding different aspects of numeracy. The materials emphasize the need for using math to communicate through reading and writing as learner's attempt to integrate those skills with math.

- Encourage learner's to use the range of tools at their disposal, particularly calculators, estimation, mental math and working with other class members.

- In every chapter, activities are provided that can be used by class members as teams or partners. Group interaction helps math learners identify their particular learning styles. Working in math teams or as math partners has been proven to be a very effective learning tool and often helps those who are involved in peer-teaching to develop a better understanding of the material as they work with a fellow math teammate or math partner.

- Each chapter in *Math Literacy* allows student's time in class to write about math in several different ways. Using a math journal is one way that class member's can use their writing skills. Writing word problems, mystery and other stories, or having students write their own lesson plans are other ways to include writing and reading in math learning. Math can be read in many places in our everyday lives from reading the newspaper, bus schedules, or television guides to grocery shopping and reading nutrition labels.

Math Literacy is divided into seven chapters. Each chapter begins with a few questions to help student's determine what they know about the chapter's topic. There are writing and reading activities throughout the chapters to aid student's in self-assessment of their learning.

- Chapter 1: Reading, Writing, and Thinking about Numbers discusses the role of reading, writing, and thinking about math in our lives. Learners are encouraged to work together with other class members either as a team or as someone's math partner. They are introduced to writing a math journal as a record of their own learning experiences and for the purpose of self-assessment.

- Chapter 2: Looking at Numbers introduces concepts of whole numbers, place value, zeros in place value, reading and writing large numbers, ordering numbers, and reading number sentences.

- Chapter 3: Estimating and Rounding Numbers offers information and practice with estimating and rounding numbers. This chapter focuses on estimation as one of the most useful tools in math learning.

- Chapter 4: Using a Calculator offers student's an introduction to calculator use with step by step instructions for operations in addition, subtraction, multiplication, division, and percents. Using a calculator frees the learner to better explore concepts and theory rather than staying with the drudgery of computation.

- Chapter 5: Measurement and Its Uses focuses on the English system of measurement. Beginning with the history of standardized measurement, this chapter will aid students in converting measurements of length, weight, and liquid.

- Chapter 6: Retelling the Story: Graphs and Charts introduces students to a variety of graphs–pictograph, circle graph, bar graph and line graph. It also instructs the learner in reading and creating graphs and charts.

- Chapter 7: Math Games includes eight games that can be played in the classroom or in the home to include the family. Play MATHO as you would Bingo and get the whole neighborhood involved! These games demonstrate that learning math is fun.

Reading, Writing, and Thinking About Math

- What Do You Know?
- Math Partners and Teams
- Writing a Math Journal
- Math and the Newspaper

Reading, Writing, and Thinking About Math

What Do You Know?

Answer the questions below. They will give you an idea of what you think about learning math. Discuss and share your ideas with your class members. Use other paper if you need more room.

1. What could be some of the advantages of working in math class with a math partner or on a math team? ______________________________

2. What do you like best about learning math? ______________________________

3. What seems to be the hardest thing for you in math? ______________________________

4. Was the same thing hard for you when you were younger? __________
Can you explain?______________________________

5. If you could change one thing about learning math, what would it be?___

6. What would you like to learn now, and how would you like to learn it?
____

Math Partners and Teams

Someone once told a story about visiting a math class. The class was very quiet as they worked on math. On the board were a list of rules for the class. All of the rules were strict, but one stood out for the visitor: "Work alone – do not speak to your neighbor!"

How often did we hear these words when we were studying math in school? The rule requiring us to work quietly and alone kept us separated from everyone in the classroom as we learned math.

Why Work Together?

Working as part of a team or with a math partner helps prepare us for the math that we do as adults. When we do math in our every day lives, we often work with other people.

Working together in the classroom can change the atmosphere to one of cooperation and generate lively discussion. Working together also reinforces the math knowledge we already have and gives us a chance to teach others what we know. Sometimes others can help us by bringing a different viewpoint to a math problem.

Working in a group or with a partner can help us build self-confidence and leadership skills. It can also help us to improve the way we communicate with each other and to realize that teaching someone else is the best way to learn.

Working together is not only important, it is also fun and makes the challenges of math less frustrating.

Activity: Building Math Teams or Working with a Math Partner

Discuss different math activities and talk about which ones would be better done in groups or in pairs rather than alone. Activities such as creating a graph or playing a multiplication game are sometimes better done in teams. Learning to use a calculator or working on a specific percent problem may be better done with a math partner.

Which class activities would you like to do working in a team?

1.____

2.____

3.____

4.____

Which activities would you like to work on with a math partner?

1.____

2.____

3.____

4.____

Working as Math Partners: Math Interview

Agree to be a math partner with someone in your class. Then interview each other about your thoughts and feelings about math and your math learning history.

Questions can include:

- How did you feel about math when you were in school?
- How do you feel about math now?
- Do you work with your children on their math?
- Do you find yourself using math in your daily life, and if so, what kinds of things do you have to do?
- What is your goal for yourself in this math class?
- Is there anything you would like to do differently in class or in math?

Working as Math Teams: The Bagel Game[1]

To play the Bagel Game, the class divides into two teams. Each team should decide on a team name to describe themselves. The teams should go over the rules of the Bagel Game carefully so that each team member knows what to do.

The Bagel Game is played at the blackboard. The board is divided in half. Each half has a bagel shape drawn in the middle of it. (See bagel on next page.) Each bagel is divided into eight sections by spokes which continue outside of the bagel. A number is placed in the hole of the bagel. Other numbers are placed in the eight sections of the bagel.

---

[1] DeLong Smith, Catherine. *Exploring Culture: We are Math Learners.* Philadelphia, PA: Center for Literacy, Inc. 1993.

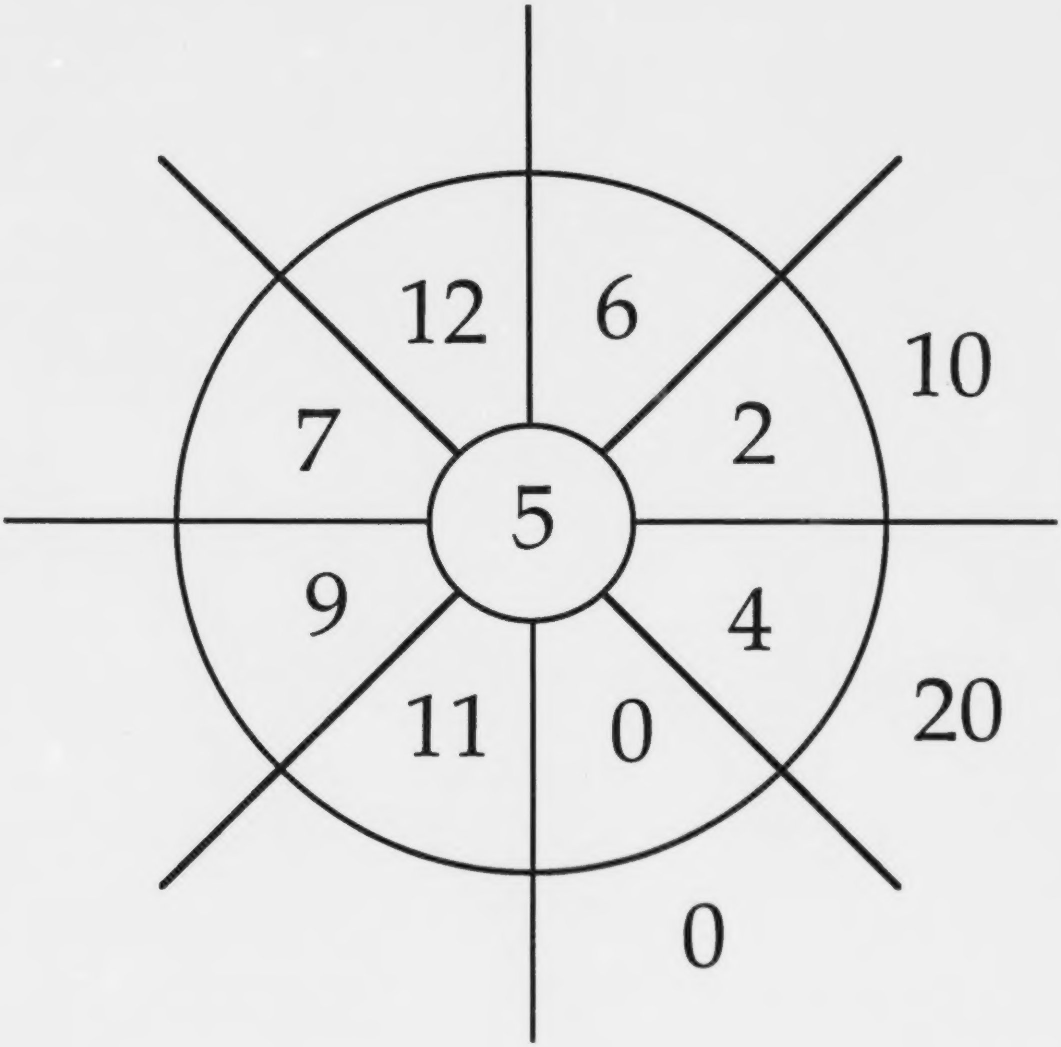
Object: Each of the numbers in the eight sections of the bagel is multiplied by, divided by, added to, or subtracted from the number in the hole of the bagel.

Members of each team take turns going to the blackboard. They challenge their math skills by either multiplying, dividing, adding, or subtracting the bagel numbers. Their answers are placed in the spaces outside of the bagel.

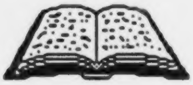
When a team member completes all the bagel problems, he or she calls out, "Done!" The opposing team then checks the first team's answers. If all the answers are correct, the point goes to the first team. If there are any incorrect answers, the point goes to the opposing team.

Bagel Game

Here is an example of the Bagel Game using multiplication.


12
6
10
7
2
5
9
4
11
0
20
0

Writing a Math Journal



What Is a Journal?

Have you ever written in a journal? Many people find it helpful to keep a journal as they learn new things. They use the journal to write about their feelings or to describe events. You can use a journal to record what you learn in math and your impressions or concerns.

A journal can be written in a spiral notebook or a bound manuscript book or on any kind of paper that is on hand. Some people write their journals on a computer. The important thing is to write your journal in a way that keeps your ideas together.

Where you record your journal is not as important as what you write, for yourself or to others.

Don't worry about the mechanics of writing when writing in your journal. Keeping a journal is not about spelling or punctuation or sentence fragments. Instead, let your feelings and ideas flow from your brain to your hand. For example, don't worry about spelling the word "calculator" correctly!

A journal can be a completely **private** activity, one that isn't shared with others. A journal can also be a **dialogue** between two or more people.

Dialogue Journal

A **dialogue journal** is a conversation that is written instead of spoken. It is a journal that is passed back and forth between you and your teacher or between you and your math partner or team. You can also use a dialogue journal to ask and answer questions. For example, in her math dialogue journal Pat wrote:

> **January 17**
> **"Anyone on my math team can answer this - what happens when I change $^1/_3$ to a decimal? Does it keep repeating or am I getting something wrong?"**

A member of her team who responded that week to Pat's journal wrote back:

> **January 20**
> **"That's one of those repeating decimals. Just quit after the hundredths place. You'll be fine."**

When you read other people's dialogue journals, don't criticize their writing. Remember, you are exchanging ideas. You and your dialogue journal partner need the freedom to express your ideas however you wish.

If you decide to keep a dialogue journal, there are some things to think about:

- **Who are you going to "dialogue" with?**

You may enjoy writing a dialogue journal with your math teacher. The dialogue journal will allow you to communicate your feelings about any problems you are having in math. It will also give you and your teacher an opportunity to think about the class.

A dialogue journal also gives you a time to ask yourself questions: Are you learning at the speed that is comfortable for you? Do you need special help with anything—for example, decimals or fractions?

- **How often are you going to write and respond?**

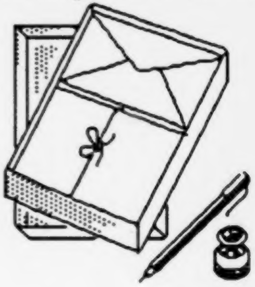
When you first start keeping a dialogue journal, "talking" to someone in writing may be so exciting that you exchange journals with your team or partner fairly often. As time goes on, you or your dialogue partner may not want to spend as much time on this activity. This reaction is common.

In deciding how often to write and respond, communicate with your dialogue partner or team. Discuss how long it will take you to read, think, and respond in writing to another person.

- **Discuss ideas about journal sharing.**

Discuss your ideas about sharing your journal with your partner. Perhaps you and your partner can set up rules for journal sharing. Even though you may share your thoughts with the partner you selected, you may not want a stranger or others in class to know about your feelings regarding math or a particular math lesson. You can agree with your partner on how you want to share your journal. You may want to talk about how trust allows you to be comfortable in your writing and that in order to be able to share with your partner, you need to trust each other.

Remember, in dialogue journal writing you do not correct someone else's writing, and you don't expect yours to be corrected unless you ask for it.



When Do I Write In My Math Journal?

The best time to write in your journal may be at the end of class, while your thoughts are still fresh. However, any time is good as long as you feel like writing.

Sometimes it is helpful to record a certain event. For example in her math journal, Melissa wrote:

March 10
"Today I won the bagel game for my math team. Everyone was amazed at how I had the multiplication tables down cold. They asked me how I learned them so well. It felt great to give advice. I told them that I learned fast helping my kids. Thursday I'm going to work with Vanessa and show her how I did it."

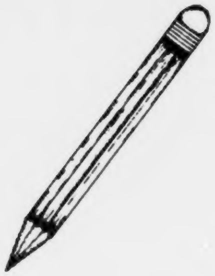
Remember to write the date each time you write in your journal. Later you will be able to go " backwards in time" and read what your thoughts and feelings were many months before. You will probably be surprised at how much you have learned and how your attitudes about math have changed.

Tara wrote in her journal in December:

> **December 8**
>
> **"I hate these percentages. I'll never understand this stuff. Who cares?"**

In February, she reread her entry, laughed and wrote the following:

> **February 6**
>
> **"Now percentages make sense. I guess I'll keep writing but sometimes I feel like I don't want to move to something new."**



Getting Started as a Math Journal Writer

Here are three questions that might help you get started writing about math:[2]

1. **What stuck with you?**

   Was there anything during class that made you excited or interested? Anything that made you want to shout, "I love math!"

2. **What didn't you understand about today's lesson?**

   Did you need more examples or more time for anything? Was the class going too fast? Did you feel left behind? Was it too slow?

3. **Did you learn anything new today?**

   Or did you remember something that you had forgotten? Was there anything that you can take home and use or share with other family members, children, or friends?

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[2] Curry, D. *Mathematics as Communication: Journey into Journal Jottings. Implementing the Massachusetts Adult Basic Education Math Standards.* Marden, MA: The Massachusetts Department of Education ABE Math Team. 1994.

Exercise:

Take 15 minutes and write about math and you. Use the space below or write in your own journal if you have started one.

Math and the Newspaper

Reading the newspaper can be an interesting way to work toward learning goals. Newspapers provide many different types of information. Some of this information includes numbers and math ideas, such as percents. We call this "numerical information."

Try this:

- **Divide up** a newspaper between math teams or partners.

  Look through a section and make a list of the kinds of numerical information (numbers and math ideas) you find. Don't forget that page indexes and weather temperatures are examples of numerical information. Use more paper if you need to.

1.______________________________ 6.______________________________

2.______________________________ 7.______________________________

3.______________________________ 8.______________________________

4.______________________________ 9.______________________________

5.______________________________ 10.______________________________

Advertisements in Newspapers

Read the newspaper ad below and underline anything that provides numerical information:

EVERY SPORT COAT
ARMANI • EAGLE • BOTANY '500'
59^{95} to 99^{95} NONE HIGHER!
COMPARABLE VALUES $250 TO $275
100% silk, 100% wool. Sizes to 60.
MON. to SAT. 10 to 9:30 SUN. 11 to 6

Let's take a look at the information provided in the ad.

"Every sport coat" tells us that the ad refers to all sport coats in the store. Some ads use words such as "selected merchandise" to tell us that not every item is on sale.

"$59.95 to $99.95 - None Higher" The key word in this price information is **to**. The advertiser is telling us that the coats will be sold at prices **between** $59.95 **and** $99.95. They could be $79.95 or $89.95 or any other amount that is between the two prices in the ad. "None higher" means that no sport coat will cost more than $99.95.

"Comparable" is another key word that gives us information. It tells us that we are getting a bargain because the sport coats have a value of $250 to $275.

"100% silks, 100% wool" tells us that the coats are made of all silk or all wool material. When something is 100%, it is all of something or the whole thing.

"Sizes to 60" tells customer what sizes are available. Since most people wear a size between 40 and 46, the ad lets the reader know that extra-large sizes are available.

"MON. to SAT. 10 to 9:30 SUN. 11 to 6" Are you familiar with time and date information? Work with your math partner to answer the following questions:

1. How many days of the week is the store open?________________________
2. How late is the store open on Tuesday night?________________________
3. When does the store open on Saturday morning?____________________
4. Is the store open the same number of hours on Sunday as it is on Friday?__

Activity: Look for other newspaper advertisements that give you similar numerical information. Take turns with your math partner in making up and answering questions about the numerical information in the paper.

Reading Ads in the Travel Section of the Newspaper:

Ads in the travel section of the newspaper provide many different kinds of information. Read the advertisement below for a trip to Bermuda.

Fly Away Airways
Vacation Bermuda Break

BERMUDA

from **$419**

SELECT GUEST COTTAGES

3 days/2 nights
$45 of taxes included in price

All 3-7 day packages include:

- *Round-trip air via Fly Away*
- *Sand Reef Hotel*
- *Travel period 5/23/94 - 6/15/94*
- *$449-$709 Optional meal plans available.*

Terms and Conditions: Prices are per person, double occupancy for round-trip for departures midweek from Philadelphia. Prices do not include passenger surcharges of up to $12 per person. Bermuda hotel tax of $20 and Bermuda departure tax of $15 for adults and $5 for ages 2-11.

As a class, make a list on the board of all the numerical information provided in the above travel ad. *Example:* 3–7 day packages.

The information in this travel ad is confusing. It also uses numbers in such a way that it is difficult to understand some of the terms and conditions of the vacation offer. Discuss with other class members what numerical information in the ad is unclear or confusing and then do the following activity.

Activity: Answering these questions will help to understand the ad.

1. Does the trip cost only $419? Why or why not?____________________

____

2. From information in the ad ("3 *days/2 nights*"), if I arrived on Tuesday, when would I have to leave?___________________________________

____

3. Can you tell from the ad what your total taxes on the trip will be?____

____

4. When can you take this trip?___________________________________

5. What does it mean when numbers have a dash (—) between them (for example, $449 – $709)?____

6. What does "surcharge" mean? (You will also find this term on your telephone bill.)____

7. Why do you think that some information is in smaller print than other information?____

Activity: Look for other travel ads in the newspaper and compare them to this ad. Find other examples of information in small print.

Reading Numerical Information

Sometimes ads present numerical information in the form of words and sentences. The ad below for a new health care plan tells you about free seminars (information classes) and some other benefits of the plan.

FREE SEMINARS ON A
LOWER-COST, BETTER
HEALTH CARE PLAN THAT
PROVIDES 100% COVERAGE.

- GET THE FACTS ON **YOUR WAY HEALTH PLAN WEST -** 100% Protection for less money than traditional Medicare Supplements!
- NEW PRESCRIPTION BENEFIT - $5 GENERIC, $10 BRAND NAME: $500 ANNUAL LIMIT
- DOCTOR VISITS JUST $2
- NO DEDUCTIBLES

CALL TOLL FREE AT 1-800-111-2222

Activity: Underline all the numerical information in the ad. Words such as "free" or "lower-cost" relate to numbers or the numerical value of something. After you have underlined the words, discuss their meaning with other class members.

Sports Math in the Newspaper

Articles about sports use numerical information all the time to let fans know how their favorite teams and players are doing.

> "Tommy Greene, who got his **first** win of the season Thursday night, was **12-0** at Veterans Stadium since **Sept. 3, 1991**."
>
> "Pete Incaviglia has collected **five consecutive** hits, reached base **six times in a row** and has hit **.455*** in his **previous seven** games."

If you or your math partner are interested in sports, discuss the meaning of the information in the bold print above.

1. Which terms can be used outside of sports?____________________
   ____
2. Which terms are specific to baseball?______________________
   ____
   ____
3. What other sports are you interested in that use numerical information to let you know what is going on with the team's or a favorite player's game?______________________________
   ____

* Batting average is the percentage of base hits that a player gets. A base hit means that a player hits the ball and gets to base without getting anyone else on his team out in the process. Batting average is computed from the total number of times that a player has gone up to bat. Example: If a player bats 10 times and he gets 5 base hits, divide 5 by 10 to get a batting average of .500.

What Else is in the Newspaper or Magazines?

Newspapers and magazines provide all kinds of numerical information. You have already made a list of some of those things. **Compare** your list with the list below.

- Medical information
- Weather forecasts, temperature
- Business information
- Carpentry directions
- Sports statistics
- Cooking recipes
- TV schedules
- Advertisements

You have now become familiar with looking for numerical information as you read newspapers and magazines. Return to the beginning of this chapter and re-read What Do You Know? with your math partner. Discuss any new information that you have learned. Write about it in your math journal.

Reading, Writing, and Thinking About Math

Lesson Plan

Goals

- To assess and explore the ways to read, write, and consider numbers.
- To examine ways that we use numbers in our lives everyday.
- To work in cooperative ways either in teams or partnerships in the classroom.
- To think about math and writing in journal form.
- To practice looking for math in different places in our lives such as the newspaper.

Materials Used

- Reading, Writing and Thinking About Math
- Paper, pencils, blackboard and chalk.
- Individual notebooks or journals for writing.
- Current daily newspapers - enough for teams or partners to have one each.

Activities

1. Pre-Reading Discussion

To begin using the materials, ask the class to talk about how and when they think about math. The questions in the assessment, What Do You Know?, might help you to get started.

2. Have the class turn to the questions in What Do You Know? and ask learners in the class to read and answer the questions.

   25 - 30 minutes should be enough time for learners to read and answer the questions. Make sure that everyone has time to work through the questions at his or her own speed. Try not to give the class the impression that you are timing them, but let them know about how much time they have to will be work on the questions.

   Have the class members go over their answers using class discussion for each question. Be aware that class discussion about math feelings and anxiety can be lengthy. If you need to limit the discussion, let the class know that at the beginning.

   Ask the class to put the assessment aside for the time being and to save it for later.

Instruction

3. Have the class turn to Math Partners and Teams. Read the introductory paragraph and Why Work Together? Ask class members if they have any other memories of how they did math in a traditional classroom.

Talk about working together as partners or as a team when doing math and how collaborative learning makes some things easier and more interesting.

4. Discuss different math activities and talk about which ones would work better either as a group or in pairs. Creating a graph or playing a multiplication game are examples of activities better done in teams. Learning to use a calculator or working on a specific percent problem works well with a math partner.

5. Read Working as Math Partners: Interview.

   Ask the class to work together as partners. Help learners choose a partner if they have any difficulty choosing or being chosen as a partner. For this activity, the instructor needs to be partners with anyone who does not have a partner.

   Ask the class to begin by using the questions in the lesson. Also ask them to record answers and any new questions for discussion later.

6. Read Working as Math Teams: The Bagel Game.

   Play The Bagel Game using the directions that are in the lesson. If the learners make up new variations, ask them to record them for later. Many learners know other games that have numbers and arithmetic in them. Ask if anyone has a game to teach such as a card game.

Ask the class to discuss how they felt working in teams. Did they like it? Was the learning fun, interesting? Would they like to do more of it? Ask them to consider how doing group activities with math, such as math games, help individuals learn and teach others.

7. Have the class read Writing a Math Journal, section, What Is a Journal.

   Discuss the differences between a **personal journal** and a **dialogue journal**.

   Ask if anyone is currently writing in a journal. Many students in recovery use journal writing and are eager to share their journal writing knowledge. Allow the class time to discuss journal writing.

8. Have the class read Dialogue Journal. Read and discuss the different questions and etiquette of dialogue journal writing. Ask if anyone has any additional ideas or agreements to add. Now is also a good time to talk about trust and dialogue journal writing.

9. Have the class read When Do I Write in My Math Journal? Discuss the "when" or time for journal writing. Even though it is suggested as an activity at the end of a math class, journal writing can take place at any time.

10. Have the class read Getting Started as a Math Journal Writer. Give class members about 15 minutes to write a journal entry.

Sustained Writing

Journal writing involves sustained writing. It is possible that the class has not practiced writing for continued periods of time or sustained writing. Sustained writing involves the following:

1. Decide how long to write (in this case, 15 minutes), and check the time.

2. Ask the class to begin writing and to write continuously. If they can't think of what to write, ask them to repeat what they have written or to write about how they can't think of what to write about. Ask them not to stop writing until the 15 minutes is up. The time allotted for writing can be shortened depending on the level of the class,.

   When students are finished, ask them to talk about how they felt as they wrote about math and their math learning. Discuss what it felt like to write without stopping for 15 (or less) minutes. Many learners find it relaxing to write without *worrying about what to say, how to say it, or spell it.*

The instructor should also use this time to write with the class as a model[3]

11. Math and the Newspaper: For this section of the lesson, the class will need newspapers to work with, either as teams or partners.

Pre-reading discussion for newspaper reading:

Discuss the newspaper and what types of information can be found in the paper. A good way to begin the discussion could be for the instructor to share what sections of the newspaper they enjoy reading, such as the comics or the TV section. One instructor often tells her class that she starts her morning by reading the comics and a column about movie stars and famous people, then reads the more serious news. Another teacher enjoys bringing in copies of letters to "Dear Abby" to her class to answer.

By discussing the different types of reading that can be found in a newspaper, learners who might otherwise be intimated might find themselves interested in reading the newspaper. The class can talk about their favorite sections.

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[3] Pomerance, Anita. *Adult Literacy Handbook for Students and Tutors. Fourth Edition.* Philadelphia, PA: Center for Literacy, Inc. 1993.

12. Read and discuss the introductory paragraph to Math and the Newspaper. The discussion should include information and examples of numerical information found in the newspaper.

13. Have the class do the activity of listing different numerical information found in the newspaper. This activity could take between 10 and 30 minutes depending on class size.

14. Read Advertisements in Newspapers.

    a. Ask the class to read the newspaper ad "Every Sport Coat" and underline anything in the ad that looks like numerical information:

    b. Ask the class to discuss their answers. Continue reading the lesson and discuss the explanations in the lesson. The activities can be done by either teams or partners.

15. Ask the class to read Reading Ads in the Travel Section of the Newspaper and make a list of numerical information that they find.

16. Ask the class members to read and answer the questions which will help them to understand the ad. Also, ask the class to discuss or explain their answers to other class members.

17. Have the class read Reading Numerical Information and ask the class to find everything in the ad that fits into that category.

Ask the class to discuss their ideas about the implications of hidden information in ads.

18. If the class is interested in sports, ask them to read and discuss Sports Math in The Newspaper. The class can also bring into the class other examples of sports information and statistics. Some learners who are sports enthusiasts will probably be willing to explain their favorite sport statistics to the class.

19. Have the class read What Else is in the Newspaper or Magazines? End the activities using the newspaper or magazines to discuss examples that learners have come across while reading items which can be interpreted as numerical information.

Individual Writing

20. Ask each class member to write about his or her experience with the reading, writing, and thinking about math lesson in his or her math journal. Some class members might want to share their writing with the class.

Looking at Numbers

- What Do You Know?
- Whole Numbers
- Place Value
- Reading Large Numbers
- Odering Numbers
- Number Sentences
- Writing Whole Numbers

Looking at Numbers

What Do You Know?

Answer the questions below. They will give you an idea of what you know about numbers. Discuss and share your ideas with your class members. Use other paper if you need more room for your answers.

1. Which number is a whole number?
   a. 3/4 b. 34 c. .34

2. Look at the numbers **127** and **217**. What is the difference in the digit **2** in these two numbers?______________________________
   ____

3. List some of the ways that place value helps you in your math:
   ____
   ____

4. What is the place value of the highlighted number 2 in the following number?**427**____The value for the number 2 is the ____ place.

5. What value does a zero have in a number?________________
   ____

6. Articles in the newspaper often refer to large numbers. Working with your math partner, read the following paragraph and answer questions 6 a., b., and c.

The Math Times Daily

On Friday, the city-wide lottery jackpot reached $348,009. People came from nearby towns to buy a ticket. The lottery will be used to help the city raise money for after-school children's programs. 476,321 lottery tickets have already been sold for this month's lottery, with an expected total of 500,000 to be sold before the drawing the last day of the month. The city hopes to raise $1,187,455 before the end of the year

6. a. How much is the lottery jackpot?____________________

b. How much does the city expect to raise before the end of the year?____________________

c. Has the city sold all of this months tickets?____________________

7. Write out the following numbers using words:

a. 732 ____________________

b. 4,405 ____________________

____

8. List the following numbers below in their size order, smallest to largest.

a. 321 **b.** 113 **c.** 1,113 · **d.** 42 **e.** 42,113 **f.** 2,011 **g.** 3,101

1.____________________
2.____________________
3.____________________
4.____________________
5.____________________
6.____________________
7.____________________
8.____________________

Whole Numbers

Look at these numbers: 1, 2, 3, 4, 5, 6, 7, 8, 9. These are called **whole numbers.** (We also use 0 in combination with whole numbers, for example, when you count to 100.) Whole numbers are **equal** to, or **more** than, the **whole number 1**. Fractions and decimals can be less than 1. **Whole numbers** can be used to count and they can be used to represent a value.

• **in measurement**	**Her son is now 3 feet tall.**
• **addresses**	**Betty lives at 820 North 56th Street.**
• **to put in order**	**She was number 1 in her class.**

Think of other uses for whole numbers:

1.____________________

2.____________________

3.____________________

4.____________________

5.____________________

6.____________________

7.____________________

8.____________________

Activity: Whole Numbers

With your math partner, look around your classroom and write down anything that has a whole number on it. Look in your book bag or purse or at anything, such as a poster or map that is on the wall. Maps and posters often have whole numbers on them.

Zeros and Place Value

Zeros do not have any real value. If someone gave you 0 apples you would have no apples. But if someone gave you 10 apples that would be different. The zero is now a place holder. With 10 apples, the 1 is in the tens place and 0 is in the ones place. You have one ten and zero ones when you have 10 apples. In the above number, 4,378,025, the zero is in the hundreds place. There is nothing (zero) in the hundreds place, but the zero is important because it is holding a place in the number. Zeros are helpful as place holders when we are writing numbers.

Place Value

Numbers such as your age or the number of your street address are whole numbers. Individual numbers are called digits. 3 is a digit until it represents something such as a toddler's age. Once the digit has a value, it is then referred to as a number.

In the space provided, write your age_____________ and your house or building number (example: **1352** Chestnut St.)_______________

Look at your age. How many **number places** does it have?_______

How many **number places** does your house number have?______

Every digit has a **place**. The number 3 has one digit so it takes up one place. The number 33 has digits and has two places. Your age probably has two places.

Words and Numbers; Letters and Digits

Words are made up of letters. Letters alone have no meaning unless we assign them a meaning such as "Row B." When we put them together to form a word, we give letters meaning. The letters "e - t - e - r" have no meaning in our language until we use them to form the word "tree." Letters are similar to digits and numbers are similar to words. We use digits to create numbers which have value.

If you saw the number 612 scattered around a room with the digit 1 on the ceiling and 2 on the floor and 6 on the table, would you be able to read these digits and decide that the number was actually 612? Probably not.

By putting the digits in the proper place, you have assigned the digits **value.** This is called **place value**. Place value gives digits meaning.

Place value is important when you do different operations with numbers. For example, when adding or subtracting numbers, it is important to align (line them up) them by place value.

You could not correctly add a column of whole numbers if it looked like this:

$$\begin{array}{l} 32 \\ 20 \\ \underline{+\ \ 432} \\ 23632 \end{array}$$

It should look like this:

$$\begin{array}{rl} 32 & \\ 20 & \\ \underline{+432} & \\ 464 & \textbf{Correct.} \end{array}$$

Each of these number places has a name. The following chart will help you to learn the names of the most important whole number places.

Place Value Chart

Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones
4	3	7	8	0	2	5

Looking at the table above, the number that is showing is written like this: **4,378,025** and read: **four million, three hundred seventy-eight thousand, twenty five.** The 4 is in the millions place. The 3 is in the hundred thousands place. 7 is in the ____________________ place. 8 is in the thousands place. ______________________is in the hundreds place. 2 is in the tens place and _______________ is in the ones place.

Fill in the above chart with the following numbers. Put the numbers in the correct place value in the chart.

a. 208 **b. 3,217** **c. 8,200,893** **d. 29**

If you think you need more practice, work with your math partner and, using numbers of your choice, discuss what place value the digits of the numbers hold. Example: Create a number — 349. The three is in the hundreds place, the four in the tens place, and the nine in the ones place.

Activity: Place Value

Figure out the place value of the numbers below. Work with your math partner if you have any problems with the larger numbers. Fill in the blanks. The first one is done for you.

1. 28 ___2___ tens and ___8___ ones.
2. 6 ________ ones.
3. 41 ________ tens and ________ ones.
4. 17 ________ tens and ________ ones.
5. 120 ________ hundreds, ________ tens and ________ ones.
6. 387 ________ hundreds, ________ tens and ________ ones.
7. 502 ________ hundreds, ________ tens and ________ ones.
8. 2,108 ________ thousands, ________ hundreds, ________ tens and ________ ones.
9. 7,896 ________ thousands, ________ hundreds, ________ tens and ________ ones.
10. 41,080 ________ ten thousands, ________ thousands, ________ hundreds, ________ tens and ________ ones.
11. 68,451 ________ ten thousands, ________ thousands, ________ hundreds, ________ tens and ________ ones.

12. 321,831 ________hundred thousands,
________ten thousands, ________thousands,
________hundreds, ________tens and
________ones.

13. 2,023,466 ________millions,________hundred thousands,
________ten thousands,________thousands,
________hundreds,________tens and
________ones.

14. 8,003,502 ________millions,________hundred thousands,
________ten thousands,________thousands,
________ hundreds, ________tens and
________ones.

Reading Large Numbers

- Each day, close to 400,000 persons cross Philadelphia's borders on their way to work. About 260,000 enter the city and 130,000 leave.
- The five-county (Bucks, Chester, Delaware, Montgomery, and Philadelphia) region's gross product (value of products made by workers in the area's five counties) is $110 billion.
- Hospital wages and salaries in Philadelphia county in 1990 were $3,464,000,000.*

* The above information was compiled by the 1994 Philadelphia Almanac and Citizens' Manual. Kenneth Finkel, Editor. Philadelphia, PA: The Library Company. 1994.

What did you think as you read the above information? Could you visualize **$110 billion** or **$110,000,000,000,** the gross product (value of products made by area workers) of the five counties mentioned? Reading and understanding large numbers can be difficult. Sometimes it helps if you can put the information into perspective, or in relation to something that you already know. If the President of the United States makes **$200,000** per year, it would take **550,000** years to earn **$110** billion. If you made **$25,000** per year, it would take you **4,400,000** years to earn $110 billion.

Visualizing Large Numbers

Try this: Here is one way to begin to visualize big numbers. You will need several snack size boxes of raisins. Work with your math partner or your math team.

A small snack-size box of raisins has 80 raisins in each box, a 100 raisins would be 20 more. Count out 100 raisins and look at the size of the pile. Imagine how large the pile would be for **1,000** or **10 times** the size of your original pile. A **million** raisins would be a **1,000 piles** of **100** raisins. That's a lot of raisins!

Library Research: In the library with your math partner or a member of your math team, research the national debt of the United States. Our national debt is in the trillions of dollars. Find out how big a trillion is. Is it smaller or larger than a billion?

Above, you thought about how many years it would take the president of the United States to earn $110 billion. With your math partner, try to figure out how many years it would take to pay off a national debt of 5 trillion dollars ($5,000,000,000,000) if we paid back $500,000 a year; $2,000,000 a year.

When you find the answer to the real national debt, try the same exercise. Compare with other teams in your class.

Commas in Numbers

Commas are used to help us read large numbers quickly. In larger numbers, commas separate numbers in groups of three.

In the number **214,326,352** (read two hundred fourteen million, three hundred twenty-six thousand, three hundred fifty-two) a comma separates the millions from the thousands. The thousands are separated from the ones by a comma. There is a pattern of grouping the numbers by three going right to left. Look at the following numbers and see the pattern.

324,569	Three hundred twenty-four thousand, five hundred sixty-nine.
43,897,333	Forty-three million, eight hundred ninety-seven thousand, three hundred thirty-three.
7,325,554	Seven million, three hundred twenty-five thousand, five hundred fifty-four.
232,899,543	Two hundred thirty-two million, eight hundred ninety-nine thousand, five hundred forty-three.
2,110,000	Two million, one hundred ten thousand.
75,802	Seventy-five thousand, eight hundred two.

It can help to give the commas names. When reading the number **2,110,000** think of the first comma from the right as the **thousand comma** and the second comma as the **million comma**. The number will read: 2 **million,** 110 **thousand.** When reading a large number, read each group of digits between the commas separately.

Read the number **313, 754, 612.** Using the commas to help you "punctuate" the number, read each group of digits. The number is read: 313 **million,** 754 **thousand,** 612. It is written like this: **Three hundred thirteen million, seven hundred fifty-four thousand, six hundred twelve.** Remember not to add the word **and** when you are reading or writing a number.

Activity:

Insert the commas in the following numbers to show place value. Use the first number as an example.

1. **44, 389, 200**
2. 21398576
3. 1234
4. 23811008
5. 7777777
6. 17321
7. 43875
8. 2018655
9. 4741235

Create large numbers and do the same as above.

1. 32,754 ______________
2. ______________
3. ______________
4. ______________
5. ______________
6. ______________

Ordering Numbers

If you had to choose the larger number, would you choose **25,987** or **110,102?** If you picked 110,102 you are correct. How did you compare these numbers?

One way to compare two numbers is to compare the digits that make up the number going from left to right.

Compare the numbers **711** and **13**.

As we compare these two numbers, we can quickly see that the number **711** has a **7** in the hundreds place and there is no number in the hundreds place in the number **13**. Therefore **711** is larger then **13**.

We can also say that **13** is less than **711** and that **711** is **not equal** to **13**.

Mathematical symbols are used when working with relationships between numbers.

Four terms are used when comparing numbers:

Is greater than	$>$	$713 > 11$	**713 is greater than 11.**
Is less than	$<$	$11 < 713$	**11 is less than 713.**
Is equal to	$=$	$11 = 11$	**11 is equal to 11.**
Is not equal to	$\neq$	$11 \neq 713$	**11 is not equal to 713.**

Practice: In the problems below, write > (greater than) or < (less than) in the space provided.

1. 31 __>__ 13
2. $62.32______$29.99
3. 2,067_____2,607
4. 81,321______81,330
5. $51.29___$57.92
6. 35,356______35,365

In the problems below, write = (equal to) or ≠ (not equal to) in the space provided.

1. 57_______59
2. $32.89______$69.99
3. 2,067_____2,607
4. 102,100______102,110
5. $42.29___$42.29
6. 35,356______35,365

Number Sentences

The symbols that you have just learned are used in writing number sentences.

Number sentences are called **equations** or **inequalities**.

Examples of Equations	**Examples of Inequalities**
14 = 7 + 7	**14 ≠ 7 + 2**
3 x 8 = 24	**3 x 4 ≠ 20**

To figure out if a number sentence is true or false, do the operation. In the first equation, **14 = 7 + 7**, you would first add **7** and **7**. You would get **14** so the equation is true.

14 = 7 + 7
14 = 14

Check the second equation to see if it is true.
3 x 8 = 24
______ = 24

Now let's look at the inequalities and see if they are true.

14 ≠ 7 + 2
14 ≠ 9

Since 14 does not equal 9, the inequality is true.

Check the second inequalities to see if it is true.

3 x 4 ≠ 20
______ ≠ 20

Number sentences can also use the greater than (>) and less than (<) symbols. Look at the inequalities in the last example. They can be restated.

$14 \neq 7 + 2$ **$14 > 7 + 2$**

$3 \times 8 \neq 20$ **$3 \times 4 < 20$**

Practice: Decide if the following are true or false. Circle T for True or F for False.

1. **a.** $3 + 2 = 5$ T F

b.. $3 + 2 \neq 5$ T F

c. $3 + 2 > 5$ T F

d. $3 + 2 < 5$ T F

2. **a.** $23 = 7 \times 3$ T F

b. $23 \neq 7 \times 3$ T F

c. $23 > 7 \times 3$ T F

d. $23 < 7 \times 3$ T F

Notice that in the first set, only one example was true. How many were true in the second set of problems?

Sometimes it is confusing to think of an **inequality** as true. Think them through carefully.

It is true that 3 plus 2 does not equal 8. Therefore $3 + 2 \neq 8$ is a **true statement**.

Practice: Circle T for True or F for False.

1. $48 + 13 \neq 61$ T F
2. $27 \times 10 = 270$ T F
3. $32 \div 8 > 4$ T F
4. $17 \times 4 < 40$ T F
5. $72 - 10 = 62$ T F
6. $99 + 1 > 100$ T F
7. $38 - 18 \neq 20$ T F

Make these mathematical sentences true. Use =, ≠, >, or <. The first one is done for you.

1. **$5 + 9 = 14$**
2. 8×5___40
3. 2×10__25
4. 38_____2×19
5. 75_____3×25
6. 3×9___31
7. 60_____5×11

Make these mathematical sentences false. Use =, ≠, >, or <. The first one is done for you.

1. **$5 + 9 \neq 14$**
2. 8×5___40
3. 2×10__25
4. 38_____2×19
5. 75_____3×25
6. 3×9___31
7. 60_____5×11

Writing Whole Numbers

> *"Julie, how much is your electric bill this month?"*
>
> *"Well, the bill came to one hundred twenty-six dollars, but Mika owes me forty-seven dollars from last month's bill. I only need to save seventy-nine dollars this month. Mika will pay me Thursday and then I'll write my check for one hundred twenty-six dollars."*

Often it is necessary to write and read whole numbers in words. When Julie writes her check out to the electric company, she will have to be able to write the numbers. Checks, money orders, and other numerical information often need numbers of amounts written as words. It is also important to be able to read numbers that are written as words.

- Numbers **1** through **20 and 30, 40, 50, 60, 70, 80, and 90** are written as follows:

one
two
three
four
five
six
seven
eight
nine
ten

eleven
twelve
thirteen
fourteen
fifteen
sixteen
seventeen
eighteen
nineteen
twenty

thirty
forty
fifty
sixty
seventy
eighty
ninety

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- Numbers **twenty-one (21)** through **twenty-nine (29)** have a hyphen **(-)**. So do thirty-one **(31)** through thirty-nine **(39)** and so on through ninety-nine **(99)**.

  Examples: thirty-three (33), fifty-two (52), forty-six (46)

  Using the examples above, write your age:______________

- Don't use the word **and** when writing numbers.

  Three hundred thirty-four (334) not three hundred and thirty-four.

  Write the following numbers in words:

1. **73**____
2. **14**____
3. **305**_______________________________________
4. **82**____
5. **36**____

- Use a **comma** after writing the word **million** and **thousand**. **Example: One million, seven hundred thirty-three thousand, two hundred forty-nine = 1,733,249.**

Activity: Writing Numbers

Follow the preceding example and write the following numbers in words.

1. **34,208**____
2. **143.812**_______________________________________
3. **99,999**____
4. **1,244**____
5. **2,111**____

The following numbers are written in words. Rewrite them using only numbers. Follow the example. Remember to place the commas after millions and thousands.

1. **four hundred thirty-two** 432________________________
2. **One hundred forty-three thousand, seven hundred sixty**________

   ____
3. **fifteen**____
4. **four million, two hundred six thousand**____________________

   ____
5. **nine hundred seventy one**______________________________

   ____

Looking at Numbers

Lesson Plan

Goals

- To understand the whole numbers, large numbers, and place value.
- To learn to read and write large numbers.
- To learn to read mathematical sentences with equations and inequalities.

Materials Used

- Looking at Numbers, Math Literacy.
- Paper, pencils, blackboard and chalk.
- Several small snack boxes of raisins.

Activities

1. Pre-Reading Discussion

   To begin using the materials, ask the class to talk about how we use place value. Also discuss large numbers, and reading and writing numbers. The questions in the assessment, What Do You Know?, might help you to get started.

2. Have the class turn to the questions in What Do You Know? and ask learners in the class to read and answer the questions.

25 - 30 minutes should be enough time for learners to read and answer the questions. Make sure that everyone has time to work through the questions at his or her own speed. Try not to give the class the impression that you are timing them, but let them know about how much time they have to will be work on the questions.

Have the class members go over their answers using class discussion for each question. Be aware that class discussion about math feelings and anxiety can be lengthy. If you need to limit the discussion, let the class know that at the beginning. The class can either go over their answers as a class or with their math partners and math teams.

Ask the class to put the assessment aside for the time being and to save it for later.

Instruction

3. Have the class turn to Whole Numbers. Ask someone to volunteer to read the first paragraph.

4. Have the class discuss additional uses of whole numbers and list them on the space provided.

5. Whole Number Activity: This is a good exercise for learners to become more aware of whole number uses. Ask class members to work with a math partner and make a list of all

of the things that they see around the room that use whole numbers. Students should look for uses that are not obvious, such as serial numbers on equipment, charts, maps, posters and personal belongings.

6. Have the learners read the opening of Place Value and Words and Numbers; Letters and Digits. Lead a discussion about numbers having value using the example of the similarities between letters and words and digits and numbers.

7. Place Value: Ask the class members to read through this section. Discuss the place value chart and how this might aid them in working with place values. Work with the class to make a larger, poster sized place value chart for the class room and include place values to the billions place.

8. Ask class members to fill in the place value chart and to work with their math partners if they need more practice. Together they can create numbers and place them in the chart or create a new chart.

9. Have the class read, Zeros and Place Value and lead a discussion about zeros. Use operations that the class is familiar with, such as addition or multiplication, using examples of problems with zeros. This will help illustrate the importance of zeros as place holders.

10. Ask the class to read the directions for Activity: Place Value activity and to work with a math partner to complete the exercise.

11. Have the learners read the first page of Reading Large Numbers. Initiate a discussion about large numbers and ask the class for examples of what large numbers they have come across in their experience.

12. Ask the class to turn to "Commas in Numbers" and read the information and do the activity either in teams or with math partners. The class might also benefit from having the activity (filling in the comas) on the board so that everyone gets a chance to understand the placement of commas. Naming the commas can be very helpful.

13. Ask the class to work as math teams or partners as they read Visualizing Large Numbers. The class will need boxes of raisins or other small objects to do the activity.

14. Encourage members of the class to do the library research activity as this is a good way to encourage math literacy.

15. Put different numbers on the board and ask students what is similar and dissimilar about these numbers. Ask them to put them in size order.

16. Introduce the mathematical symbols for less than< and greater than >. Discuss how symbols are used in mathematics

to make understanding functions and qualities about numbers easier and quicker, similar to short-hand notes. Now ask the class to read Ordering Numbers and lead a discussion about comparing numbers.

17. Ask students to do the practice exercise with their math partners.

18. Have students read Number Sentences. Discuss how different symbols in number sentences are similar to punctuation in word sentences. Ask students to do the practice exercise with their math partners.

19 Ask class members to turn to "Writing Whole Numbers" and discuss different times in our everyday lives when we might find it necessary to use written numbers.

20. Ask class members if they have any trouble with the spelling of particular numbers. Explain that now is a good time to practice and become familiar with writing those numbers. Have students do the writing exercises.

Estimating and Rounding Numbers

- **What Do You Know?**
- **Estimating**
- **Rounding Numbers**
- **Estimating on Graphs or Charts**
- **Real Life Problems**
- **Create Your Own Problems**

Estimating and Rounding Numbers

What Do You Know?

Answer the questions below. They will give you an idea of what you know about estimating and rounding numbers. Check your answers and ask yourself if they make sense.

1. What does it mean when you receive an estimated utility bill, such as an estimated electric bill?____
   ____

Mental Math: Answer questions 2, 3, and 4 in your head. Use mental math; do not use paper and pencil to work your answers.

2. If you needed several notebooks, and one notebook cost **$2.89**, about how much would **6** notebooks cost?______________________________
3. You are at the grocery store. You only have **$10.00** with you and you do not have paper and pencil. Do you have enough money to buy the following items: **mustard, $ .63** **milk, $2.29** **sliced roast, $4.79** **tuna, $1.19** **cherry pie, $2.99?**
   ____

1/4 lb. Hamburger		**$2.59**	
1/4 lb. Cheeseburger		**$2.79**	
Fries	**Sm. $ .99**	**Med. $1.19**	**Lrg. $1.29**
Coke	**Sm. $ .79**	**Med. $ .99**	**Lrg. $1.19**

4. Using the above chart, estimate your bill for the following items:

- **1/4 lb. Hamburger, 1 Med. Fries, 1 Lrg. Coke.**____________________

- A *Value Meal* includes a **1/4 lb. Cheeseburger, Lrg. Fries,** and **Lrg. Coke**. If it costs **$3.99**, is it a better deal than the order above? *(Remember not to use paper and pencil)*____________________

5. You have a new TV set. It will only fit against the living room wall that has no windows. The electrical outlet is on another wall, away from where you want to put the TV. How can you estimate the distance between the TV and the electrical outlet to see if the cord will reach?

____

____

____

____

Estimating

We work with numbers all the time and often it is not important to use exact numbers. We may not know or even need the exact number.

Why Do We Estimate?

There are times when we need to use **exact numbers.** Here are some examples:

- Fares for train or subway.
- Paying the baby-sitter.
- Measuring the floor for a rug or linoleum.

Often, we ***don't*** need exact numbers. When we don't need the exact number, or we don't know the exact number and want to **approximate** or get close to it, we **estimate**. Here is an example:

- "I went to the store this morning and there must have been **300** people there."

It is possible that the **exact** number of shoppers was **289,** but for the purpose of describing the crowd, an estimate of **300** gives the listener a good idea of how many people were in the store.

When you are in the grocery store, you need to know if you have enough money to buy what is in your cart. You can come close to the total without needing to add to the exact penny. This is another example of estimating.

Which would you say? Circle your answers.

• I got up at 8:02.	or	I got up around 8 o'clock.
• I spend $61.32 a week on food.	or	I spend between $60 and $70 weekly on food.
• It's 11:03. Are you ready to go?	or	It's a little after 11:00. Are you ready to go?

Numbers that are not exact are estimates.

Other Examples of Estimating

- Estimating distance, such as how far it is between home and City Hall.
- Giving directions, such as estimating how many blocks someone should go before making a turn.
- Planning one's time, estimating how long it will take for a chore, errand, or task to be done.
- Estimating how long it will take to get from one location to another on foot, in a car, or by bus.

Estimating Worksheet

Write about some of the ways you use estimating in your daily life. Some ways might include cooking, buying food, and looking at time. Work with a math partner, the class, or alone.

Key Words

There are key words and phrases which are clues to tell you that an exact number is not necessary. They include **about, approximately, around** and **on average.**

Can you think of any others?____

____

Deciding When to Estimate

In each of the following situations, decide if you can use an **estimated** number or if you need an exact number. Circle your answers.

1. How much does the subway ride cost for two adults?

   a. estimate b. exact

2. Do you have enough money with you to buy groceries?

   a. estimate b. exact

3. When you bought groceries, how much change did you receive?

   a. estimate b. exact

4. What time does your bus leave the bus terminal?

   a. estimate b. exact

5. How long does it take you to get downtown by bus?

   a. estimate b. exact

6. How much time does it take you to bake a cake?

   a. estimate b. exact

7. How much flour do you need for the cake?

   a. estimate b. exact

8. Your baby is sick. Your doctor asks if the baby has a fever.

   a. estimate b. exact

9. You know it's cold outside. What kind of coat should you wear?

   a. estimate b. exact

10. You are going to the movies. When does the movie start?

    a. estimate b. exact

11. Your nephew has done some odd jobs for you. He gets paid by the hour and wants you to pay him for the work he has completed.

    a. estimate b. exact

Sometimes it is important to know **exact numbers**. If your baby is sick, it is important for the doctor to know that the baby's temperature **is** 104° and not **about** 100°. On the other hand, it is not that important if you know whether it is 33° or 36° outside before you leave the house. Your **experience** tells you that it is cold outside and you will need a coat.

Life experience can help us to decide when we need **exact numbers** and when we can **estimate** something. Our experience and our knowledge of things helps us to estimate.

Estimation is something we can learn to do. Our skill at estimation can get better with practice. For example, you probably use your experience to **estimate** how long it will take to get to work.

- You can estimate how long it will take you to get ready for work in the morning because you have had experience getting up and preparing to leave the house.
- While the schedule may say that the bus leaves your stop at 7:42 a.m. and arrives at your job at 8:06 a.m., your experience tells you that if it's raining or there is a lot of traffic the bus will be late.

Perhaps on your first day of work you trusted the bus schedule's exact numbers and were late for work. Your experience will tell you to include more time in your estimate for how long it will take you to get to work the next day.

Practice Estimating

- **Saturday Shopping Trip**

One way to use estimating is to plan the use of your time. Make a schedule for a Saturday shopping trip on the Schedule Worksheet on the following page. Estimate the time that each activity—such as traveling on a bus or shopping for dinner—will take. If you plan to bring children or a friend along, don't forget to add time to your estimates. Specifically:

1. Make a list of all of the things that you have to get done during the day. Then write down an estimate of the time you think it will take you to perform each task or activity.

2. After you accomplish each activity, write the actual time it took and any comments that might help you to estimate more closely in the future. **Example:**

Activity	Estimated Time	Actual Time	Notes
Get up, dress, eat breakfast	$1\,{}^{1}/_{2}$ hr.	45 minutes	skipped breakfast
Bus to downtown	30 minutes	1 hour	bus late, slow
Lunch with Diane	1 hour	$1\,{}^{1}/_{2}$ hours	talked about Ray
Stop at grocery store	45 minutes	30 minutes	hooray - no lines
Pick up kids at mom's	15 minutes	1 hour	cup of coffee, talk
Totals:	**4 hours**	**4 hours, 45 minutes**	

Schedule Worksheet

Activity	Estimated Time	Actual Time	Notes

Total estimated time:______________ Total actual time:______________

Practice: Estimating

We can use household and other familiar objects to practice estimating skills. You will need:

1 small snack-size box of snack raisins
1 large box of raisins
1 1 lb. box of elbow macaroni

How Many Raisins in a Snack Box?

1. Look at the snack-size box of raisins. Estimate (guess) how many raisins are in the box. Write your estimate on a piece of paper.
2. After you have written down your estimate, count the raisins in the snack box.
3. You now know how many raisins are in the snack-size box. Look at the large box of raisins. Compare the small box to the large box. Can you estimate how many raisins are in the large box? Write your estimate down.
4. If you are working in class, the class can divide into teams and work together to come up with team estimates.

How Many Pieces of Macaroni in a 1 Pound Box?

Look at a 1 lb. box of elbow macaroni. This box should have a window in the front that shows some of the macaroni inside the box.

1. Count the macaroni that you see in the window.

2. Now that you know how many individual pieces of macaroni are in the window, estimate how many pieces of macaroni are in the whole box.

3. Record your estimate and share it with your classmates.

4. To find out how close your estimate is, divide the contents of the macaroni box among the class members and ask them to count the number of macaroni pieces they have. Compare the estimates with the total count.

Who Uses Estimating?

Choose one or more of the following and list ways they use estimation.

Mechanic____

Painter____

Butcher____

Mother____

We need to estimate for certain jobs or chores. Some people use numbers every day for the same type of task so they become very good at estimating.

Here are some examples:

- A baker can estimate a teaspoon of salt.
- A painter can measure a room and estimate how much paint it will need.
- Someone who sews often can estimate how much material is needed for a shirt or pants.

- A father can estimate the family's grocery bill from the shopping list.

Can you think of other ways that you or someone you know is good at estimating? Does your job or someone else's rely on estimating?

____

____

____

The more we work with numbers, the more we can use estimation to make working with numbers easier.

More Practice Estimating

Now, let's learn to estimate in centimeters.

This line is 3 centimeters long. ______________

This line is 6 cm (centimeters) long. ____________________________

How long is this line? __________

Now draw a line 5 cm long in the box below.

The line below is 8 cm long.

____

About how long is this line? ___________________

About how long is this line? _____________

Draw a line 7 cm long in the space below.

You just taught yourself to **estimate** centimeters.

Rounding Numbers

Rounding numbers is a way to make them easier to use. Rounding is helpful when an exact number isn't necessary.

Here is an example: The number **289** can be rounded to **300**.

It is closer to **300** than **250** or **200**.

As we have seen, sometimes we don't need an exact number. You round a number so that you have zeros at the end of the number — for example, **289, 304,** and **610** become **300, 300,** and **600**. This makes working with the numbers easier.

When Do You Round Numbers?

At a restaurant...

- Adding what items you want to order to check if you have enough money with you.
- Checking the total on the bill.
- Figuring out the tip.

In the grocery store...

- Adding up groceries before you purchase them.
- Figuring out how much is saved on cents-off coupons.

- **List other times when you round numbers.**

Steps for Rounding Numbers:

1. Mark the digit in the place to which you want to round.
2. If the digit to the right of the marked digit is 5 or more, add 1 to the marked digit.

   If the digit to the right of the marked digit is less than 5, do not change the marked digit.
3. Replace the digits to the right of the marked digit with zeros.

Examples:

Using the steps above, round **729** to the nearest **hundred**.

1. 729 Mark the digit 7 in the hundreds place.
2. 729 Look at the digit to the right of the 7, which is the digit 2. Is it 5 or less? Since it is less than 5, do not change the 7.
3. 700 Replace the digits to the right of the 7 with zeros.

Let's look at these steps again with another number. Round **1,689** to the nearest **thousand**.

1. 1,689 Mark the digit 1 which is in thousands place.
2. 1,689 Look at the digit to the right of the 1, which is 6. Is it 5 or more? Since it is more than 5, we add 1 to the 1 in the thousands place to get a 2.
3. 2,000 Replace the digits to the right of the 2 with zeros.

Here is another way to show how to round numbers.

To round the number **289** to the closest hundred, first put it in a row with the numbers that are the closest hundreds to it.

It will look like this: 300
289
200

If we are talking about money, which dollar amount would be closest to $289?

$300 $ 11 more - **closer**
$289
$200 $ 89 less - not as close

So **$289** rounded to the nearest **hundreds place** is **$300**.

Now let's try rounding **304** to the nearest **tens** place.

310 6 away, not as close
304
300 4 away - **closer**

So **304** rounded to the nearest **tens place** is **300.**

Practice: Rounding Numbers

1. Round each number to the nearest **ten**.

a. 37
b. 8,232
c. 46
d. 102

2. Round each number to the nearest **hundred**.

a. 510 b. 78,327 c. 219 d. 2,168

________ ________ ________ ________

3. Round each number to the nearest **thousand**.

a. 23,587 b. 5,802 c. 321,854 d. 1,714

________ ________ ________ ________

4. Round each number to the nearest **hundred-thousand**.

a. 754,844 b. 325,999 c. 1,232,542 d. 672,203

________ ________ ________ ________

5. Round each number to the nearest **million**.

a. 4,212,638 b. 8,932,507 c. 43,267,945 d. 283,348,321

________ ________ ________ ________

Rounding Numbers with 9's

Let's now look at what happens when we use the steps above to round the number **9**.

If we are rounding **396** to the closest **ten**:

1. 396 Mark the digit 9 in the tens place.
2. 396 Look at the number to the right of the 9, which is the 6 in the ones place. Is it 5 or more? Since it is more than 5, we add 1 to the 9 in the tens place. The 9 becomes **10**.
3. 400 To show this, we put a 0 in the tens place and carry the 1 to the hundreds place, which changes the 3 to a 4. We then replace the digits to the right of the 4 with zeros.

The number **396** rounded to the nearest **ten** becomes **400**.

Let's look at these steps again with another number. Round **1, 978** to the nearest **hundred**.

1. 1,978 Mark the digit 9 which is in hundreds place.
2. 1,978 Look at the number to the right of the 9, which is the number 7 in the tens place. Is it 5 or more? Since it is more than 5, we add 1 to the 9 in the hundreds place. The 9 is now a 10.
3. 2,000 To show this, we put a 0 in the hundreds place and add 1 to 1 in the thousands place, which changes the 1 to a 2. We then replace the digits to the right of the 2 with zeros.

The number **1,978** rounded to the nearest **hundreds** is **2,000**.

Practice: Rounding Numbers with 9

1. Round each number to the nearest **ten**.

a. 595
b. 78,389
c. 296
d. 2,199

3. Round each number to the nearest **hundred**.

a. 23,978
b. 5,699
c. 321,769
d. 1,999

4. Round each number to the nearest **ten-thousand**.

a. 798,765
b. 398,976
c. 1,299,888
d. 677,989

5. Round the money amounts below to the nearest **dollar**. In example (**d**), the number is written to the hundredth cent as is often seen on the pump for the price of a gallon of gas.

a. $29.99
b. $98,876.98
c. $68.79
d. $1.298

6. Make up your own numbers and practice rounding to the nearest **ten, hundred, thousand, hundred-thousand,** and **million.**

Number	Place Rounded to	Rounded Number
72,380	tens place	72,380

7. Write two word problems which ask you to use what you know about rounding numbers.

Example: You are at the grocery store. You only have **$10.00** with you, and you do not have paper and pencil. Do you have enough money to buy the items below?

mustard, $ .63 milk, $2.29 sliced roast beef, $4.79
tuna, $1.19 cherry pie, $2.99

A. ____

B. ____

Estimating on Graphs or Charts

Graphs and charts organize numerical information so that we can easily read and compare it. The numerical information on a graph or chart is an **approximation** or **estimate**. The symbols represent rounded numbers. Our practice with estimating and rounding will help us to understand charts and graphs better. Example:

Casino Earnings from Slot Machines in 1992
Atlantic City, New Jersey

Each $ = $1,000,000

Trump Plaza	$ $ $ $
Caesar's	$
Trop World	$ $ $
Trump Taj	$ $

SOURCE: NEW JERSEY CASINO CONTROL COMMISSION

As noted on the table, each $ (dollar sign) represents **$1,000,000** (one million dollars) that the casinos earned from players of the slot machines. We can quickly compare casino earnings by counting the number of dollar signs. For example, Trump Plaza earned twice as much as the Trump Taj— $4,000,000 (four dollar signs) compared to $2,000,000 (two dollar signs). In comparing the take of the different casinos, it is not important that we know that the Trump Plaza earned exactly $4,089,323. The rounding of the numbers and their representation through pictures or symbols allows us to make the comparison easily.

Real-Life Problems

1. At the gas station, there are three different prices for gasoline: $1.299 a gallon for premium, $1.199 a gallon for medium grade, and $1.099 a gallon for regular. Our money system doesn't use hundredths of a cent. Round the prices of each gasoline to the nearest cent.

   $1.299____________ $1.199____________ $1.099____________

2. Caroline wants to purchase a new sofa at a department store. The sofa costs $299.00. There is also a matching chair at a cost of $49.00. She has $325.00 so far. About how much more money does Caroline need to buy both the sofa and the chair?____________

3. Patricia earns $426.38 a week. Round Patricia's weekly salary to the nearest hundred dollars.____________

4. Patricia's brother James makes $1,532 a month. Round James' salary to the nearest hundred.____________

5. The average rent of a new apartment with utilities is $575.00. Round the cost to the nearest ten.____________

6. Maxine is shopping and has three items she wants to buy:

   toothpaste ($1.29) face soap ($ .79) lipstick ($3.89)

   Round the price of each item to the nearest dollar amount. How many dollars does she need? ____________

Create Your Own Problems

Divide into small groups and write word problems from your own lives that require rounding numbers. Use more paper if you need additional writing space.

A.

B.

Estimating and Rounding Numbers

Lesson Plan

Goals

- To explore the concept of estimating.
- To examine ways to estimate things in our lives everyday.
- To see how rounding numbers helps us to estimate.
- To practice estimating.
- To practice rounding numbers.

Materials Used

- Estimating and Rounding Numbers, Math Literacy.
- Paper, pencils, blackboard and chalk.
- Several small snack boxes of raisins; 1 large box of raisins; 1 box, any size, elbow macaroni with window on the front of the box.

Activities

1. Pre-Reading Discussion

To begin using the materials, ask the class to talk about what they know about estimating numbers and rounding numbers. Discuss with the class some practical examples such as: Going to the grocery store and checking to see if we have enough money for the things we want to buy (this would also include rounding numbers for ease of computation); planning our schedule for a hectic day which might include doctor appointments for ourselves or our children; cooking enough food to serve several hungry people.

2. Have the class turn to the questions in What Do You Know? and ask learners in the class to read answer the questions.

   25 - 30 minutes should be enough time for learners to read and answer the questions. Make sure that everyone has time to work through the questions at his or her own speed. Try not to give the class the impression that you are timing them, but let them know about how much time they have to will be work on the questions.

   Have the class members go over their answers using class discussion for each question. Be aware that class discussion can be lengthy. If you need to limit the discussion, let the class know that at the beginning.

   Ask the class to put the assessment aside for the time being and to save it for later.

   Instruction

3. Read the introductory paragraph to Estimating. Ask the question, "What are some of the ways you use estimating?" Ask a class member to record the answers on the board. The rest of the class can record the responses on their work sheets. This will give additional practice in listening and writing.

4. Read Why Do We Estimate?

    a. Ask for other examples of when exact numbers are needed. Again record answers and have class members keep notes on the worksheets provided.

    b. Ask the class for other examples of when estimated numbers are okay to use. Example: Figuring out a monthly budget. Rent $580, Electric $29.00, Heat $62, Phone, $27.00. You would need about $700.00 per month to cover these bills.

5. Read Other Ways to Use Estimating. Discuss other ideas the class might have for ways to use estimating. Have the class think of specific examples for each of the examples used in the text. This will be one of the focuses of the chapter, to think of why and when we use estimating and to acknowledge estimating as an important math skill.

6. Take a few minutes for writing on the Estimating Worksheet.

7. Read key words: **about, approximately, around, on average, exact**.

8. Lead a discussion about life experience and how we can develop math intuition. Ask the class for examples of when they use their experience to figure things out.

9. Read: Deciding When to Estimate, and ask the class to work through the problems. Discuss answers. Explore why different answers might be correct for different people. For example,

someone who bakes regularly might be good at estimating the amount of flour.

10. As a class, brainstorm ways to use estimated numbers in your daily life. There is space on the page for written responses.

11. Read: Practice Estimating, Saturday Shopping Trip. The class can work as teams to develop an estimated schedule for a typical Saturday. Discuss how writing down estimated times for certain tasks can help in planning and managing time. Parents can help their children develop time management skills in estimating how long it takes to do different tasks, such as their math homework.

12. Activities: Practicing Estimating, Raisins and Macaroni

Materials needed:
1 small snack box of raisins, 1 large box of raisins, 1 box of elbow macaroni with window on the front of the box for each team or math partner group.

Raisins:

a. Allow the class to work in groups, as teams, or as math partners. Have the class do the activities of estimating and counting the raisins. Record the information.
Later in, Retelling the Story: Graphs and Charts, the class can use this information to create graphs about the raisins using the different estimates.

To introduce the visual concept of larger numbers, ask the class questions about the raisins after they have estimated the number in the large box. Questions to ask might include: What would a pile of 100 raisins look like? 1,000? How about 10,000? Can you picture a pile of 10,000 raisins? How many large boxes would that be?

b. After counting the number of elbow macaroni in the box's window, the class should attempt to guess how many macaroni are in the box. Again have the class work as teams or math partners; after they have recorded their estimates, the teams and partners can count the contents of the box and compare it to their estimates.

13. Read and discuss: Who Uses Estimating? and ask the class to work through the page and respond to the questions. Share responses.

14. Talk about measurement and how we can learn to "eyeball" something through experience. If we know that one child is 4 1/2 feet tall, can we guess the height of a younger child? If we know how tall we are, can we guess the height of someone else?

    a. Have someone who knows his or her height, stand next to a door and have the class estimate the height of the door frame by comparing the known person's height to the door frame. Allow them to use any means that they come up with to estimate and problem solve. As an example, they might know that if the person standing next to the door raised their arms, two feet could be added to the height of that person, making it easier to estimate the height of the door.

b. To reinforce this concept, use the exercise on estimating length in centimeters.

15. Read the introductory paragraph to Rounding Whole Numbers. Going around the room, ask class members to round their ages to the nearest tens place using your own age as an example. (32 becomes 30)

16. Read: When Do You Round Numbers. Allow the class time to brainstorm different ways in everyday life that rounded numbers might be used. Have one learner volunteer to record answers on the board. Ask other class members to take notes on their worksheets.

17. Read: Steps for Rounding Numbers.

    a. Discuss the examples and demonstrate step by step on the board.

    b. Practice Rounding Numbers: Start some of the practice numbers of this exercise on the board as examples. Have class members complete #'s 1 - 5 of the worksheet.

18. Read: Rounding Numbers Ending in 9.

    a. Again, discuss the examples and demonstrate step by step on the board.

    b. Practice Rounding Numbers Ending in 9: Again, start some of the practice numbers of this exercise on the board as examples. Have class members complete #'s 1 - 5 of the worksheet.

c. Exercise #6 provides a worksheet for the class to create their own examples of numbers to round. They can also incorporate numbers ending in 9 in this exercise.

19. Exercise #7: Writing word problems. If the class hasn't started to use word problems yet, now is a good time to begin. Use the example as a model. Ask the class to come up with a story that uses numbers which they will round. The story can include members of the class. Ask someone to volunteer to record the story. Everyone else can take notes on the worksheet. Either you or a class member can type up the story for each class member or for another class.

20. Ask the class to read: Estimating on Graphs or Charts. Discuss why charts and graphs are used and how they simplify information. Ask the class to look for graphs and charts in newspapers and magazines and bring some into the class. If the class is familiar with library research, include looking up charts and graphs as part of research skills. Reading graphs and charts is included in "Retelling the Story: Charts and Graphs."

21. Ask the class to read: Real Life Problems. Ask different class members to lead discussions of the problems and to come up with the answers or the class can break into small groups and work on the problems as a team. The winning team can receive

a certificate or some other recognition. Have teams complete Complete Your Own Problems.

22. Give the class copies of the beginning assessment. When the class has checked their answers, ask them to compare this assessment with their first assessment and have the class discuss any differences that they notice.

Individual Writing

23. Ask each class member to write about his or her experience with the estimating and rounding lesson in his or her math journal. Some class members might want to share their writing with the class.

Using a Calculator

- What Do You Know?
- When to Use a Calculator
- How to Use a Calculator
- Setting up the Problem
- Real Life Problems

Using a Calculator

What Do You Know?

Answer the questions below. They will give you an idea of what you already know about using a calculator. As you check your answers, remember to ask yourself if they make sense.

- *You will need to use a calculator to answer the questions.*

1. What keys do you press to enter the dollar amount **$2,748.83**? Fill in the blanks below.

   [ ] [ ] [ ] [ ] [ ] [ ] [ ]

   Did you remember to enter the decimal point?____________________

2. Do you need to enter the dollar sign?____________________

3. Do you need to enter the comma after the digit 2?____________________

4. The **(+)** key is called the add key or the addition key and allows us to add numbers. What is the **(-)** key called and when would you use it?

   ____

5. What is the **(=)** key called and when would you use it? ____________

   ____

6. Write the number and function keys that you use to answer the following calculations in the spaces provided. The first one is done for you as an example.

   Tip: The number of spaces provided can help you figure out how to fill out the answer. Don't forget your **equal sign** for each problem. Also you do not need to calculate these problems now.

   a. seventy-three minus twelve

   (7) (3) (-) (1) (2) (=)

   b. eighteen plus thirty-two

   ( )( )( )( )( )( )

   c. six-hundred twenty-nine plus four

   ( )( )( )( )( )( )

   d. thirty-six dollars divided by four

   ( )( )( )( )( )

7. Solve the following problems using your calculator.

   a. 73 - 29 =

   b. 832 ÷ 4 =

   c. 49 x 7 + 3 =

   d. 232 + 3,213 + 42 =

   e. 237,203 + 6,910 =

   f. Darlene gained 18 pounds in the first five months of her pregnancy. She has four months remaining of her pregnancy. She plans on gaining only three pounds each month for the remaining four months. Using your calculator, figure the total number of pounds that Darlene wants to gain during all nine months of her pregnancy.____________________________________

8. Which problems below are answered incorrectly? Use your calculator to check the answers.

a.
$$\begin{array}{r} 2{,}466 \\ +\ \underline{8{,}233} \\ 9{,}669 \end{array}$$

b.
$$\begin{array}{r} 17{,}854 \\ -\ \underline{6{,}589} \\ 11{,}265 \end{array}$$

c.
$$\begin{array}{r} 42{,}328 \\ 4{,}824 \\ +\ \underline{56{,}391} \\ 72{,}433 \end{array}$$

d. 71 x 16 = 1,136

e. 2,464 ÷ 2 = 1,231

f. 36 - 18 = 16

Why Use a Calculator?

This chapter focuses on some of the functions that are common to most calculators and provides a brief overview of how calculators are used.

We work with numbers all the time, whether we are at home, at school, or at work. In learning about estimating and rounding, we learned that it is often not important to have exact numbers. There are times when we do not know or even care what the **exact** number is, and we estimate to get the answer.

There are also times when we do need exact numbers, and we compute (do or figure) the problem in our heads, on paper, or with a **calculator**. In any case, it is important to have an idea of what our answer should be. This helps us to know if we are doing the problem correctly.

Activity

Use your estimating skills to work out the problems below. Circle the number that is the closest to your estimate of the answer. If you have difficulty remembering how to estimate, refer back to the steps in "Estimating and Rounding Numbers."

812 + 104 =	700	800	900
38 x 5 =	20	200	2,000
453 – 50 =	400	450	500

Estimating and Using the Calculator

As we discussed, it is good to estimate **before** you use your calculator. This will help you to figure out if you used the calculator correctly and did not miss any of the numbers. Your second step would be to solve the problem with the calculator and compare your answer with your estimate. They should be close.

For each problem below, circle the number which is closest to your estimate. Then work the problem on your calculator. Some of the choices below are incorrect because a mistake was made on the calculator. Can you guess what mistake was made to get the incorrect answers?

10 + 4 =	5	6	14	
812 + 104 =	708	826	916	
38 x 5 =	43	33	190	7.6
453 – 50 =	503	403	458	448

Computing Problems

It is important to know how to go about solving a problem. Knowing how to do, or compute, a problem can help us when we need to work with numbers in other areas of our lives.

Look at the following examples. Match each statement with its correct computation.

1. Alex had $10.00. He lost $4.00. How much does he have?
2. Vanessa had $10.00. She found $4.00. How much does she have?
3. Sandy saved $10.00 each week for 4 weeks. How much does she have?

a. 10 x 4 = 40

b. 10 – 4 = 6

c. 10 + 4 = 14

Remember to first estimate and then use the calculator. If your answer is close to the estimate, you will know that you have computed the problem correctly on the calculator.

As an example, if you were adding 57 + 79 + 21, you could first estimate by rounding the numbers to 60 + 80 + 20. It's easy to add in your head 6 + 8 + 2 which equals 16. Now we add a zero making our estimate 160. If you use the calculator and come up with an answer of 1,570, you know from your estimate, you have made an error. Now you can recheck your calculations with the calculator.

Examples

Here is an example of using estimation along with your calculator:

- You have worked part-time for a store over the holidays. To be eligible for a bonus, you have to work 50 hours during December. Estimating will help you know whether it's worth taking the time to add up your exact hours. After estimating the number of hours you have worked, you can use your calculator to find the exact number to see if you are eligible for the bonus.

Your hours for December are:

8 17 23 2

Is it worth doing the exact calculation? In other words, is your estimate close to 50?

Did You Know?

- It has been widely shown by math teachers[4] that having the **knowledge** and **ability** to use a calculator correctly, helps math learners better understand the math that they are studying.
- Students who use calculators, even if they are not allowed to use them during a test, **score higher** than students who do not regularly use calculators. Another important reason to master the calculator!

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[4] Manly, Myrna. *Problem Solving for the GED*. Chicago, IL: Contemporary Books. 1993.

When to Use a Calculator

We estimate to get a ballpark number, or a good idea, of the number we need, but if we need an exact number, we can use a calculator for a **quick** and **exact** answer. Here are some of the ways using a calculator can come in handy:

- measuring carpeting, wallpaper, wood, fabric
- computing taxes, balancing checkbooks
- adding up work hours for a time sheet
- figuring out percentages
- totaling a grocery order

Can you think of other times you could use a calculator?

Being able to use a calculator correctly and easily is necessary in our world. Using a calculator will enable you to do calculations quickly and accurately, giving you time to think about the problem rather than the computation. It will free you to use your critical thinking and math skills to set up problems and consider what you are doing to solve the problem.

Although you may be able to add several large numbers very well, it is faster to use a calculator than to take the time to add the numbers with a pencil and paper.

- **Try this:**

1. Add the following numbers using a pencil and paper.

   34,521 + 87,389 + 12,674 + 73,909 =

2. Now, use a calculator to add the numbers. Compare how long the problem takes on the calculator with how long it took on paper.

   If you don't know how to use a calculator, ask someone in the class to do the problem with you. You will learn how to use a calculator later in this chapter.

Calculator Tip

- Sometimes people add things twice on the calculator to see if they get the same answer. By first estimating your answer, you will have a better idea of what the correct calculator answer should be. This will help you if you happen to make the same mistake or a new mistake the second time you do the calculation.

How to Use a Calculator

Turning on Your Calculator

If the calculator you are using has a battery, it will have **ON** and **OFF** keys or one **ON/OFF** key. When you press the **ON** key, the display window should show a **0**.

If there is nothing in the display window when you turn your calculator on, check to see if the battery needs replacing.

If your calculator is **solar-powered**, you will need to work in a room that has good light.

Solar-powered means that your calculator has cells that absorb and use light to power the calculator. Some solar-powered calculators also have a battery as a back up for the solar cells. Solar-powered calculators either have **ON** and **OFF** keys or they turn on when you open the calculator cover, exposing the **display window** to light. If there is not enough light, a solar-powered calculator will not work. This is a disadvantage of a solar-powered calculator, but the advantage is that you never have to change a battery!

Digit Keys

Now look closely at the calculator (your own or the diagram on this page). Most calculators have several keys in common. All calculators have the ten **digit keys**: **0, 1, 2, 3, 4, 5, 6, 7, 8, 9**. The digit keys are used to enter numbers into a calculator. Find each digit key on your calculator.

Digit keys are also found on other machines. Some examples are: cash registers, automatic teller machines (ATM's), telephones, TV remote controls, and computer keyboards. Do you use other machines that have the same digit keys?

____

____

____

Now that you have identified the digit keys, play with your calculator. Press some of the digit keys and see how your calculator works. Press other keys and see if you can figure out what they do or what their **functions** are.

- What happens when you press the **2** and the **+** key and the **6** and the **=** key?
- Try other digits and keys: **− ÷ X %**

Let's look at how numbers are entered into the calculator. Enter one digit at a time.

Example: Enter your age. If you are **28**, first press the digit **2** and next press the digit **8.**
28 should show up on the **display window**.

Clear (C), All Clear (AC) Key

To clear a display of numbers that you no longer want, press the **clear key**, the **C** key on the calculator. Find the **C** key on your calculator. **Press** it and see how the numbers on your display window disappear. You have cleared the numbers, or erased them. Everyone makes mistakes and this key erases mistakes and allows you to enter new numbers. Your calculator might have an **AC, or all clear,** key which works the same way.

Calculator Tip

- **It's best to press the AC or C key before each problem.**

  This ensures that the calculator is working with only the numbers that you want. It will be a clean slate, with no numbers remaining in the calculator from another calculation.

Practice:

Enter and clear the following numbers on your calculator. Notice that you **do not include the comma** when entering numbers in a calculator.

a. 34
b. 47
c. 386
d. 710
e. 213
f. 5,870
g. 6,895
h. 2,110
i. 32,579
j. 89,909
k. 269,541
l. 677,900

Enter your own numbers into the calculator and then clear them from the display window. Write down the numbers you make up.

______________ ______________ ______________
______________ ______________ ______________
______________ ______________ ______________

CE or Clear Entry Key

Your calculator might also have a **CE** key. The **CE** key allows you to clear or erase the **last number** you entered.

If you have a **CE** key, try the following:

1. Enter your age.

2. Press the **+** key.

3. Enter a friend's age. As an example for now, use 32 for your friend's age.

   Note: Your calculator may automatically add after two or more numbers have been entered. Thus, your display screen might read your age ***plus*** *32. Don't worry because the next steps will clear your calculator the same as if it did not add the numbers before you press the "=" key..*

   Suddenly, you remember that your friend is now **33**, not 32. Don't press any other keys yet.

4. Now press the **CE** key **only once** and the 32 will be erased. You may now enter **33**.

   The calculator will remember the first number. You will not have to re-enter your age. The number will still be in the calculator's memory. Only the last number, **32**, will be erased, allowing you to enter the correct number, **33**.

Some calculators add or tally numbers as they are entered. If the calculator you are using works this way, you do not need to press the (=) key. If your calculator hasn't given you the answer after you entered the last number, press the (=) key for the total. You will have added your age and your friend's age.

The total of your age plus 33 is ____________.

Calculator Tip

- Don't forget to **clear** your calculator before going on to another problem!

Try adding other numbers. Here is another example:

Cindy's children are ages **4, 7, 12.**

Press keys: **4 + 7 + 12.**

Do not press the + key after you enter 12. The display will read **12 which is the last number entered.**

Press the **CE** key. The display will now read **11**. The number **12,** the last number you entered has been cleared.

Now enter **13 and press the (=) key**. The answer will be **24**.

Many calculators have a **CE/C** key.

If you press the **CE/C** key **once**, it will **clear entry**, or **CE**. In other words, it will erase the last number you entered, in the same way as the **CE** key, and you can continue with your calculations.

If you press the **CE/C** key **twice**, it will **clear all of the numbers which you have entered.**

Practice:

If your calculator has a **C/CE** or **CE** key, do the following practice.

Make up numbers that you want to add. Use the **CE** key to change the last number you entered. Don't forget to use the **(+)** key between each number that you want to add. Press the **(=)** key to get your answer.

Example problems

1. Enter **12 + 24 + 16**; press **CE** and change **16** to **15**. Press the **(=)** key. Your answer should be **51**.
2. Enter **67 + 83 + 94 + 102**; press the **CE** key and change **102** to **104**. Press the **(=)** key. Your answer should be **348**.
3. Enter **379 + 490**; press the **CE** key and change **490** to **493**. Your answer is______________________.

The calculator helps you add several large numbers quickly and accurately.

Calculator Tip

- Remember, you can only **clear** or erase the last number entered with the **CE** key. If you **do not** have a **CE** key, then you cannot erase the last number entered. If you press the **C** key, it will erase **all** of your calculations.

Now try making up your own addition problems using the **CE** and **C** keys. Write them in the space below. If you have a math partner in class, work together to create problems for each other.

Before starting any problem remember:

- **If your calculator has an AC, or all clear key, use that to clear your calculator.**
- **Estimate the answer first, then use the calculator. The answers should be close. This means that you are using the calculator correctly.**

Setting Up the Problem

Your calculator has four **function** keys: **+** (addition), **−** (subtraction), **x** (multiplication), and ÷ (division). Lets look at these keys and how they are used to set up specific number problems.

Function Key (+) Addition

You have already used the **+** function key. Follow the directions to solve this additional problem: **66 + 82 = ?**

Steps	Display
Enter (C) clear.	
Enter the number **66**.	**66**
Press **+**	
Enter the second number, **82**.	**82**
Press **=**	**148**

Note: Some calculators add numbers as you enter them, giving you a running total. If your calculator does this, you will not need to press the equal key.

Practice:

a. $\begin{array}{r} 66 \\ +\ \underline{33} \end{array}$

b. $\begin{array}{r} 328 \\ +\ \underline{779} \end{array}$

c. $\begin{array}{r} 63{,}754 \\ 7{,}433 \\ \underline{98{,}529} \end{array}$

d. 743 + 32 + 398 =

e. 1,258 + 3,567 + 873 =

f. 42 + 157 + 77 =

Work with your math partner to create addition problems. Write your work in the space below. Use more paper if necessary. Estimate your answers before using the calculator.

Function Key (–) Subtraction

Follow the directions to solve this subtraction problem: **82 – 63 = ?**

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number **82**	**82**
Press the – key.	
Enter the next number, **63**	**63**
Press the = key.	**19**

Practice:

a. $\begin{array}{r} 59 \\ \underline{-\ 31} \end{array}$ b. $\begin{array}{r} 685 \\ \underline{-\ 430} \end{array}$ c. $\begin{array}{r} 3{,}285 \\ \underline{-1{,}529} \end{array}$

d. 327 – 32 = e. 1,692 – 567 = f. 157 – 42 =

Work with your math partner to create subtraction problems. Write your work in the space below. Use more paper if necessary. Estimate your answers before using the calculator.

Function Key (X) Multiplication

Follow these steps to solve the problem: **82 x 63 = ?**

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number **82**	**82**
Press the **x** key.	
Enter the next number, **63**	**63**
Press =	**5,166**

Practice:

a. 66 x 33

b. 328 x 779

c. 63,754 x ,433

d. 743 x 32 =

e. 1,258 x 3,567 =

f. 42 x 157 =

Work with your math partner to create multiplication problems. Write your work in the space below. Use more paper if necessary. Estimate your answers before using the calculator.

Function Key (÷) Division

Division is dividing one number by another. The number being divided is called the **dividend** and the number doing the dividing is called the **divisor**. The answer is called the **quotient**.

Follow these steps to solve the problem: **82 ÷ 2 = ?**

Note: **82** is the **dividend** and **2** is the **divisor**.

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number **82** (dividend)	**82**
Press the ÷ key	
Enter the next number, **2** (divisor)	**2**
Press =	**41**

Practice:

a. 48 ÷ 4 =

b. 126 ÷ 3 =

c. 3,285 ÷ 5 =

d. 327 ÷ 3 =

e. 1,692 ÷ 6 =

f. 156 ÷ 12 =

Work with your math partner to create division problems. Write your work in the space below. Use more paper if necessary. Estimate your answers before using the calculator.

Function Key (%) Percentage

Calculators can make percents easier to figure out but first you need to determine what type of percent problem you are solving.

Problem 1: 25% of $60.00 = ? Answer: 25% of $60.00 is $15.00

In this problem you are trying to find out how much 25% is of all the money or the $60.00.

Here are the steps to use the calculator to find what part of a whole a percent is for the problem: **25% of $60.00 = ?**

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number representing the whole: **60**.	**60**
Press the **x** key	**60**
Enter the number of the percent: **25**	**25**
Press **%**	**15**

Note: On some calculators, you need to press the **=** key to get the answer. Practice with the calculator you use to see if that's necessary.

Practice:

a. 15% of 40 =

b. 12% of 35 =

c. 40% of $79.00 =

d. 50% of $85.50 =

e. 3% of 47 =

f. 30% of $49.99 =

g. Every day Shanta spends 20% of her $12.00 allowance on car fare. How much does Shanta spend on car fare in one day?____________________
How much does she spend if she goes to work five days?____________

h. Jay wants to buy a shirt which originally cost $72.00. It is now on sale and is marked 30% off the original price. How much will he have to pay for the shirt now?________________

Problem 2: $15.00 is what percent of $60.00?

Answer: $15.00 is 25% of $60.00

In this problem you are trying to find out what percent $15 is of the whole or, in this case, $60.

Here are the steps to find a percent of a whole on a calculator:

Steps	Display
Enter **C** or **AC** to clear.	
Enter the number representing the part. Enter **15**	**15**
Press ÷	**15**
Enter the number of the whole: **60**	**60**
Press %	**25**

Note: On some calculators, you might need to press the = key to get the answer. Practice with the calculator you use to see if it is necessary.

Practice:

a. 18 is what percent of 40?

b. 20 is what percent of 75?

c. What percent of 60 is 15?

d. $36.00 is what percent of $98.00?

e. 24 is what percent of 88?

f. What percent of $56.00 is $8.00?

e. 26% of what number is 78?

f. 3% of what number is 12?

g. Pat has paid off her credit card. She paid a total of $16.00 in interest payments on her card. Her interest rate was 12%. What was the total that she owed on her card when she paid the balance? ____________________

h. Ross's puppy, Germane, gained 4 pounds, which is 45% of the weight that he is suppose to gain in every month. How many pounds total should Germane gain in a month?_______________

Write two word problems using what you know about how to use calculators.

A. ____

____

____

____

____

____

B. ____

____

____

____

____

____

Real Life Problems

Use your calculator to answer the questions below. Estimate your answers before you use the calculator. Remember to clear the calculator before you start each problem.

1. You make $8.40 an hour, and you work 40 hours per week. How much do you make a week?____________ A year?_____________________

2. Your son wants you to be treasurer of his club. They are collecting cans to recycle for cash to donate to their school for new computers. So far they have earned: September, $234.98; October, $321.67; November, $578.32; and December, $187.65. You need to make a year end treasurer's report.

   What is the total money they have made? __________________________

   They gave the money they made in September to another club. What is the total that they will be donating to the school for computers?

   ____

3. Michelle is driving to New York City from Philadelphia on Saturday. It is 90 miles from her house to New York. If she drives 55 miles per hour, how long will it take her to get to New York City? ______________

   Hint: This is a division problem. Divide the total number of miles she will travel by the speed (miles per hour) at which she will drive.

   If she stops for lunch for a half hour, how long will it take her to get to New York City? ___________________

4. Robert has asked Rhonda to dinner. He is going to cook. He goes to the market with $30.00. This is what he wants to buy: 3 pounds of steak ($3.89 per lb.); 2 baking potatoes ($ .33 each); lettuce ($1.99); peppers (3 for $2.00); frozen peas ($1.49); French bread ($1.69 per loaf); custard pie ($3.29). How much will he spend on dinner?________________

   Will he be able to buy a bottle of red wine for $14.99?________________

   The wine store allows customers to make purchases with a money access card. How much will Robert have to take out of his savings account to buy the wine he wants?_____________________

Using a Calculator

Lesson Plan

Goals

- To explore the use of a calculator as a math tool.
- To examine ways calculators help in calculations, such as speed and ease of use.
- To practice basic functions of arithmetic and percents.
- To practice estimating.
- To practice rounding numbers.

Materials Used

- Using a Calculator, Math Literacy.
- Paper, pencils, blackboard and chalk.
- Calculators: enough for individual use or math partner use.

Activities

1. Pre-Reading Discussion

To begin using the materials, ask the class to talk about what they know about calculators.

Does anyone have a calculator and when do they use it?
What would be some good uses of a calculator?
Are there other things in their lives that have similar key pads to calculators? (example: telephones, remote controls)

2. Have the class turn to the questions in What Do You Know? and read and answer the questions.

   25 - 30 minutes should be enough time for learners to read and answer the questions. Make sure that everyone has time to work through the questions at his or her own speed. Try not to give the class the impression that you are timing them, but let them know about how much time they will be working on the questions.

   Have the class members go over their answers using class discussion for each question. Be aware that class discussion can be lengthy. If you need to limit the discussion, let the class know that at the beginning.

   Ask the class to put the assessment aside for the time being and to save it for later.

   You might also consider leading a discussion on how using calculators can make doing some math easier and faster. Examples: Adding up columns of numbers for a monthly budget; figuring out income taxes; or checking answers on a GED practice test.

Instruction

Instructors' Note:

As stated in the workbook, this lesson is an attempt to approach some of the uses and functions that are common in using calculators.

3. Read: Why Use A Calculator. You might begin discussion by asking the question, "When are some of the times when you need an exact answer?" You might want to refer to the chapter, Estimating and Rounding Numbers. Ask a class member to record the answers on the board. Another learner can record the responses on paper. This will give additional practice in listening and writing.

4. It is important that learners are comfortable with the concept of estimating so that they will be able to perform the correct functions on the calculator. Explain that by being able to estimate an answer, you are able to judge whether or not you have used the calculator correctly. Example: 979 + 806 = ? Rounding 979 to 1,000 and 806 to 800, the estimated answer is 1,800. If in using the calculator, the answer appears as 173, the user can readily see that a mistake has been made if the anticipated answer is not close to the estimate. Practice finding the closest estimate in the exercise.

5. Read: Estimating and Using the Calculator. This reinforces estimating the answer and comparing to the calculated answer.

6. Read: Computing Problems. this exercise helps the learner match the written word to the correct computation. This also helps learners think more in terms of word problems and problem solving.

7. Read: When to Use a Calculator, and ask the class to discuss ways when it would be convenient to use a calculator. The learners can record their answers on the space provided. Discuss answers. Explore the positive attributes of calculator use. Many adult learners think of calculator use as "cheating" or not really doing math. Discuss how a calculator can help reinforce problem solving.

8. Calculator Tips: Please take time out at each calculator tip and have the class discuss its meaning and how it relates to their calculator use learning.

9. Learners should be given an opportunity at this time to become familiar with their calculator. Suggest that they play with the calculator to see if they come up with any discoveries of their own.

10. The class should work as partners or teams to go through the sections, How To Use A Calculator and Setting Up the Problem. As each function is studied and learners feel comfortable with using the calculator, suggest that they write word problems together which correspond to the calculator function.

Provide assistance to pairs or teams as needed. Review points with the whole class if needed.

11. Read: Real Life Problems. Ask different class members to lead discussions of the problems and to come up with the answers or the class can break into small groups and work on the problems as a team. The winning team can receive a certificate or some other recognition. Have teams create their own word problems.

12. Give the class copies of the beginning assessment. When the class has checked their answers, ask them to compare this assessment with their first assessment and have the class discuss any differences that they notice.

Individual Writing

13. Ask class members to write about their experiences with the calculator lesson in their math journals. Some class members might want to share their writing with the class.

Measurement
and
Its Uses

- What Do You Know?
- Why Call a Foot a Foot?
- Why Measure?
- Measurement of Length
- Measurement of Weight
- Measurement of Liquid

Measurement and Its Uses

What Do You Know?

Answer these questions. They will give you an idea of what you know about using different ways to measure. Check your answers and remember to ask yourself if they make sense.

1. Which would you use — a ruler or a yardstick — to measure a piece of material 6 inches long?____________________

   22 inches long?_______________

   36 inches long?_______________

   3 feet long?_________________

2. Your sister asks you to buy 4 yards of lumber. When you get to the lumberyard, you discover that lumber is sold by the foot. How many feet of lumber do you need? _________________

3. Suzanne's new baby, Maxine, weighs 6 lb. 4 oz. The visiting nurse needs to convert the new baby's weight to ounces. How many ounces does Maxine weigh?_______________

4. You need two gallons of milk for the children's birthday party. The store only has quarts. How many quart containers of milk will you need to buy to have two gallons of milk?______

5. There are 12 ounces of soda in your soda can. How much soda is in the can in cups and ounces? _________________

6. Your daughter is now 48 inches tall? How tall is she in feet and inches?____________________

7. The dress you are making for your brother's wedding needs 42 inches of lace trim. When you go to the store, they will only sell it to you by the yard. How many yards will you have to buy, even though you will have some lace left over?________________

   How many inches of lace will you have left over?____________

Units of Measure

Measures of Length

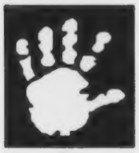
1 foot (ft.) = 12 inches (in.)
1 yard (yd.) = 3 feet
1 mile (mi.) = 5,280 feet

Measures of Weight

1 pound (lb.) = 16 ounces (oz.)
1 ton (t) = 2,000 pounds

Liquid Measures

1 cup (c.) = 8 ounces
1 pint (pt.) = 16 ounces (oz.)
1 quart (qt.) = 2 pints
1 gallon (gal.) = 4 quarts



Why Call a Foot a Foot?

Body Parts and Measurements

Many years ago, when people first started farming and buying and selling land in England, distance and length were measured by using different body parts. One **foot** equaled about the length of a man's shoe or boot. An **inch** was about the length of a finger between the first and second finger joints. An open hand like the one pictured above measured a **span**, the distance between a normal man's little finger and thumb. The distance from a man's nose to his fingertips if he held his arm straight out to his side, is about one **yard** or three feet. This is still a good estimate of a yard. A **pace** was the distance between a man's two feet when he was walking. A **mile** was a thousand paces.

Standard Measurements

These measurements were not standard (always the same) because people's body parts were different sizes but they did give an **estimate** of the **measurement**. If we didn't have **standard measurements**, people's idea of an inch or a foot would depend on the size of their fingers or shoes.

Standard measurement was developed so that measurements would be the same for everyone, always the same size. Now when you ask to buy five feet of pipe or ten inches of ribbon, you know that you will receive a standard measurement wherever you shop. When you buy milk in a half gallon carton, you know that you will receive a half gallon of milk no matter which company's milk you buy!

English and Metric Systems of Measurement

- There are two common types of standard measurement, English measurement and metric. This chapter will focus on English measurement.

- English measurement is the standard of measurement that is used in the United States. It is called the English measurement system because it was used in all of the countries that once belonged to the British Empire. Few countries besides the United States use it today. Most countries use the metric system.

Measurement of Length

Standard Units of Length

Unit	Abbre-viation	Description
inch	in.	12 in. = 1 ft. 36 in. = 1 yard (yd.)
foot	ft.	1 ft. = 12 in. 3 ft. = 1 yd. 5,280 ft. = 1 mile (mi.)
yard	yd.	1 yd. = 36 in. 1 yd. = 3 ft. 1,760 yd. = 1 mi.
mile	mi.	1 mi. = 5,280 ft. 1 mi. = 1,760 yd.

Measuring with an English Ruler

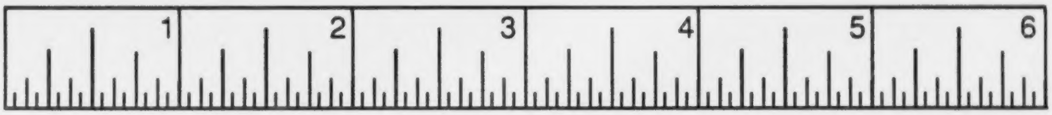
Rulers are used to measure length. English rulers are usually 12 inches—or 1 foot— long and measure inches. Yardsticks are 36 inches long—3 feet or 1 yard—and are used to measure inches, feet, and yards. Measuring tapes can be very long—up to 129 inches—and are useful to measure fabric, building materials, and straight lines, such as room dimensions.

Take a look at your ruler. What do you notice about it? Write down the things that you see on your ruler.____

Do the same with a yardstick or measuring tape. ____________________

The Ruler

The ruler is divided by units called inches. There are six inches on this ruler.



Each inch is divided into fractions or parts of the inch. Read the ruler from **left to right** the same as you would a sentence.

- The ruler is divided or marked off in fraction of inches to make it easier to read. Each inch is divided into halves, fourths, eighths, and sixteenths. Notice the marks on your ruler that are different heights. They represent 1/2 in., 1/4 in., 1/8 in. and 1/16 in.
- Can you find each half inch mark? A half inch is one half of an inch. There are two one half inches in one inch.

Now that you've become familiar with the ruler, measure objects around you such as a piece of paper or a book. Bring in objects to class to practice measuring with the ruler, yardstick, or measuring tape. Keep track of what you measure and record the measurements. Work with your math partner or your math team.

Activity: Measure the following:

shoe ____________________
paper clip ____________________
pencil ____________________
table or desk ____________________

Now find other objects to measure. Record your findings.

Object	Measurement

You need to know how to convert inches to feet; feet to inches, yards, or miles; and yards to miles. You can learn how to change **smaller units** of measurement such as **inches** into **larger units** such as **feet**. Likewise you can learn to change larger units into a smaller units. Later you will be able to use similar formulas to convert weight and liquid measurements.

Converting Measurements of Length

First determine how many smaller units (inches) are one unit of the larger unit (feet). There are 12 inches (smaller unit) in 1 foot (larger unit).

- **When converting inches to feet, the smaller unit is the inch. The larger unit is the foot.**

Next divide the number of smaller units you have, by the number of the smaller units in the larger unit.

Example: Change 48 inches into feet.

Step 1: There are 12 in. in a foot.

Step 2: You have 48 inches so you divide the 48 inches by the 12 inches in a foot.

Answer: 48 in. ÷ 12 in. = 4 ft.
48 in. = 4 ft.

Another example: Change 67 inches to feet.

Step 1: Determine how many smaller units are the larger unit.
There are ________ inches in **one foot**.

Step 2: 67 in. + 12 in. = 5 ft. 7 in.
When you divided, you saw that **12** does not divide into **67** equally. You had a remainder of **7** which represents the inches you have left over that do not equal another foot. You had **$^7/_{12}$** of a foot left over. It is commonly written as **5 ft. 7 in.**

Practice: Convert the lengths of inches below to feet. Remember, your remainders are written as inches.

Example: 42 in. = 3 ft. 6 in. 42 divided by 12 equals 3 ft. and a remainder of 6 inches.

1. 24 in. ________________
2. 17 in. ________________
3. 49 in. ________________
4. 56 in. ________________
5. 124 in. ________________

- **These steps work to convert all units of measurement. You can also do the same with yards and miles.**

Practice:

Using the chart at the beginning of the chapter, convert the lengths of feet below into their **largest** unit of measurement. It could be yards or it could be miles. Don't forget to write any remainders as feet.

Example: Convert 48 ft. into yards.

First: Determine the smaller unit — **feet**.

How many feet in each yard? — **3**

Then: Divide the total number of feet (**48**) by the number of feet in a yard (**3**): 48 ft. ÷ 3 ft. = 16 yds.

1. 14 ft. 4 yd. 2 ft.
2. 72 ft. ______________
3. 5,759 ft. ______________
4. 9 ft. ______________
5. 3 ft. ______________

You can also convert larger units into smaller units.

- **Feet can be converted into inches.**
- **Yards can be converted into feet or inches.**
- **Miles can be converted into yards, feet, or inches.**

Example: Convert 18 feet into inches.

Step 1: 1 ft. = 12 in.

Step 2: 18 ft. x 12 in. = 216 in.

Answer: 18 ft. = 216 in.

Another example: Convert 9 ft. into inches.

Step 1: Using the chart on page 130, determine how many smaller units are in the larger unit.

There are _______ inches in **one foot**.

Step 2: **Multiply** the number of larger units (9) times the number of the smaller units in each of the larger units (12).

Answer: 9 ft. x 12 in. = 108 inches.

Activity: Converting to Inches

How tall are you?____________ Convert your height into inches.

Example: Tamika's height is **5 ft. 3 in.**

5 ft. x 12 in. = 60 in.

Add the remaining **3 in.**

60 in. + 3 in. = 63 in.

Tamika is **63 in.** tall.

Ask your math partner, class members, family members, and friends their height and convert them to inches.

Name	Height	Inches
Jenny	5 ft. 8 in.	68 in.

Measurement of Weight

Standard Units of Weight

Unit	Abbreviation	Description
ounce (lb.)	oz.	16 oz. = 1 pound
pound	lb.	1 lb. = 16 oz.
ton	t	1 t = 2,000 lb.

Weight is the measurement of how heavy an object is. The basic unit of measurement in weight is the **pound** which is divided into **ounces**. The largest unit of measurement is a **ton**.

How much do you think you weigh?____________________

How much do you think you weighed when you were born?______________

How about your son or daughter or a family member?________________

Adults measure their weight in pounds. When babies are born, they are weighed in pounds and ounces. You might say, "Ray was a big baby — he weighed 9 lbs. 5 oz.!"

As you see from the chart, **16 ounces (oz.)** is equal to **1 pound (lb.)**. (The ounces in a pound are not the same ounces used to measure liquids.) There are **2,000 pounds** in a **ton.** A car weighs about **1 ton (t)**. Become familiar with the abbreviations. The abbreviation for a ton is the small letter "t" without a period.

- Picture familiar objects in your mind and think about how much they weigh. For example, how much meat do you buy to make a meat loaf? Many meat and grocery items are weighed in pounds and ounces.

  How much do bigger objects weigh? Your car? A ship? An elephant? Big objects such as these are weighed in **tons (t)**.

A. With your math partner or team, think of other things that are weighed in **pounds.** Record your answers. *Examples*: flour, sugar

1.______________________ 4.______________________

2.______________________ 5.______________________

3.______________________ 6.______________________

B. How about **ounces?** Again discuss with your math partner or team and record your answers. *Example*: spices, cheese

1.______________________ 4.______________________

2.______________________ 5.______________________

3.______________________ 6.______________________

Converting Measurements of Weight

Converting one weight to another is similar to converting measurement of lengths. Use the same steps.

First determine how many smaller units (**ounces**) make up the larger unit (**pounds**). There are **16** ounces (smaller unit) in **1** pound (larger unit).

Next divide the number of smaller units (**ounces**) by the number of smaller units in each larger unit.

- **Example:** Convert 48 ounces = _______pounds.

  Step 1: 16 oz. = 1 pound

  Step 2: 48 oz. ÷ 16 oz. = 3 lb.

  Answer: 48 oz. = 3 lb.

- **Another example:**

  82 ounces = _______________ pounds.

  Step 1: Using the chart on page 137, determine how many smaller units are in the larger unit. There are __________ **ounces** in **1 pound**.

  Step 2: 82 oz. ÷ 16 oz. = 5 lbs. 2 oz.
  When you divide, you realize that **16** does not divide into **82** equally. You have a remainder of **2** which represents the ounces left over that do not equal another pound.

  Answer: **5 lb. 2 oz.**

- You can change **pounds to tons** the same way.
- 2,000 pounds equal 1 ton.

Practice: Change each weight. Don't forget to write any remainders as pounds or ounces.

Example: 32 oz. = 2 lb. 16 divided into 32 equals 2 lb.

1. 24 oz. = ______ lb. ______ oz.
2. 80 oz. = ______ lb. ______ oz.
3. 3,150 lb.= ______ t ______ lb.
4. 23 oz. = ______ lb. ______ oz.
5. 2,145 lb. = ______ t ______ lb.

- **You can also change larger units (pounds and tons) to smaller units (ounces and pounds).**

Pounds can be changed to ounces.

Tons can be changed to pounds and ounces.

Example: Convert 22 pounds =______ ounces.

Step 1: 1 lb. = 16 oz.

Step 2: 22 lb. x 16 oz. = 352 oz.

Answer: 22 lb. = 352 oz.

Another example: 3 tons = _________ pounds.

Step 1: Determine how many smaller units are in the larger unit. There are ______ pounds in **one ton**.

Step 2: **Multiply** the number of larger units (3 t) times the number in the smaller unit (2,000 lb. = 1 t)

Answer: 3 t x 2,000 lb. = 6,000 lb.

Change each weight. Don't forget to write any remainders as pounds or ounces.

Practice:

Example: 6 lb. = 96 oz. 6 lb. multiplied by 16 oz. equals 96 oz.

1. 14 lb. = _________oz.
2. 3 t 325 lb. = ________lb.
3. 150 lb.= ________oz.
4. 6 t = _______lb.
5. 45 lb. = _____oz.

Measurement of Liquids

Standard Units of Liquid

Unit	Abbre-viation	Description
ounce	oz.	8 oz. = 1 cup (c.)
pint	pt.	1 pt. = 2 c. = 16 oz.
quart	qt.	1 qt. = 2 pt. = 32 oz.
gallon	gal.	1 gal. = 4 qt. = 128 oz.

The units that are used to measure capacity are **fluid ounces***, **cups**, **pints**, **quarts**, and **gallons**.

- **Remember, a *fluid* ounce is different than an ounce in weight measurements.**

  Fluid ounces measure *liquid* and ounces measure the solid weight of an object.

How many cups of soda do you think you drink in a week?__________________

Do you buy milk in gallons, quarts, or pints? __________________

Have you ever mixed baby formula measuring fluid ounces?________________

- **8 fluid ounces (oz.)** is equal to **1 cup (c.)**. There are **2 cups** in a **pint.** A small container of milk or ice tea is often a **pint**.

- Collect containers around your home that milk or other liquids come in and check the liquid measurements. Soda cans are usually 12 fl. oz. That 's equal to 1 $^1/_2$ cups of soda or 1 cup and 4 ounces. Since 8 ounces is one cup, 4 ounces is one half of a cup.

A. With your math partner or team, discuss what other things that are measured in ounces, cups, pints, or quarts. **Example:** ice cream, pints, and quarts. Record your answers.

1.________________________ 4.________________________

2.________________________ 5.________________________

3.________________________ 6.________________________

B. How about **gallons**? **Example:** gasoline. Again discuss with your math partner or team and record your answers.

1.________________________ 4.________________________

2.________________________ 5.________________________

3.________________________ 6.________________________

- Using the table on page 142, you should be able to convert the different measures for liquid in the same way that you did for lengths and weights.

- Do you ever wonder how many gallons of water you use every day?

  With your math partner or math team, investigate at the library how much water the average person in your town uses. Compare this to other cities and countries.

Converting Smaller Units of Liquid Measure to Larger Units

First determine how many smaller units (**fluid ounces**) make up the larger unit (**cup**). There are **8** ounces (smaller unit) in **1** cup (larger unit).

Next divide the number of smaller units (**fluid ounces**) by the number of smaller units in the larger unit (8 oz.).

- **Example: Converting fluid ounces to cups**

  Problem: Convert 24 fl. oz. = ________cups

  Step 1: 8 fl. oz. = 1 cup
  Step 2: 24 fl. oz. ÷ 8 fl. oz. = 3 cups

  Answer: **24 fl. oz. = 3 cups**

- **Another example: Converting pints to quarts**

  Problem: 17 cups = __________ pints.

  Step 1: Determine how many smaller units (cups) are in the larger unit (pints).

There are ______ cups in **1 pint**.

Step 2: 17 c. ÷ 2 c. = 8 pt. 1 c.

When you divided you became aware that **2** does not divide into **17** equally. You had a remainder of **1** which represents the number of **cups** left over that do not equal another pint. Write it as **8 pt. 1 c.**

- **You can change quarts to gallons the same way.**

Practice

Change each liquid measure to its larger unit. Don't forget to write any remainders as their measurements of fluid ounces, cups, pints, quarts, or gallons.

Example: 6 qt. = 1 gal. 2 qt. 4 qt. divided into 6 qt. equals 1 gal. 2 qt.

1. 24 oz. = ________ c.
2. 78 qt. = ________ gal. ________ qt.
3. 92 pt.= ________ gal. ________ qt.
4. 8 pt. = ________ gal.
5. 9 qt. = ________ gal. ________ qt.

- **You can also change larger units (cups, pints, quarts, and gallons) to smaller units (fluid ounces, cups, pints, and quarts).**

Example:

Problem: 20 gallons =____ quarts

Step 1: 1 gal. = 4 qt.
Step 2: 20 x 4 = 80 quarts

Answer: **20 gal. = 80 quarts.**

Another example:

Problem: 5 gallons = ____qt.

Step 1: Determine how many smaller units are in the larger unit.

There are ______ **quarts in one gallon.**
Step 2: **Multiply** the number of larger units (5 gal.) times the number in the smaller unit (4 qt. = 1 gal.)

Answer: 5 gal. x 4 qt. =20 qt.

Practice:

Change each measurement.

Example: 6 qt. = 12 pt. 6 qt. multiplied by 2 pt. equals 12 pt.

1. 17 gal. = ________________qt.

2. 3 qt. = ________________pt.

3. 15 pt. = ________________c.

4. 6 c. = ________________oz.

5. 42 gal. =________________qt.

Activity: Word Problems

1. Tanya bought 3 gallons of milk for her son's birthday party. How many cups will she have?____

2. Matthew needs to serve punch at the birthday party. He needs to know which measurement is larger: 8 pints or 3 quarts?________________ How much larger?________________

3. To make his punch, Matthew needs to know that 1 quart is equal to ____________pints, _________cups, and ______________ ounces. He needs to have 23 ounces of orange juice for the punch. How many cups is that?_________How many pints?_____________

Measurement and Its Uses

Lesson Plan

Goals

- To explore the concept of the English measuring system and understand some of the history of this system.
- To examine ways to use measurement in our lives everyday.
- To become familiar with terms and definitions of length, weight, and liquid.
- To practice estimating in measurement.
- To practice measurement of length, weight, and liquid.

Materials Used

- Measurement and Its Uses, Math Literacy.
- Paper, pencils, blackboard and chalk.
- Rulers, yardsticks, tape measures, Different size soda bottles, cans, other containers.

Activities

1. Pre-Reading Discussion

To begin using the materials, ask the class to talk about what they know about measurements of length, weight, and liquid. It can also be useful to introduce tools for measuring - rulers, yardsticks, measuring cups - and to discuss what learners already know about these tools.

2. Have the class turn to the questions in What Do You Know? and ask learners in the class to read and answer the questions.

   25 - 30 minutes should be enough time for learners to read and answer the questions. Make sure that everyone has time to work through the questions at his or her own speed. Try not to give the class the impression that you are timing them, but let them know about how much time they have to will be work on the questions.

   Have the class members go over their answers using class discussion for each question. Lead a discussion on how measurement is used in our daily lives. Examples: Buying material for sewing, following a recipe, measuring a child's height. If you need to limit the discussion because of time, let the class know that at the beginning.

   Ask the class to put the assessment aside for the time being and to save it for later.

Instruction:

3. Ask a class member to volunteer to read the Units of Measure chart. Let learners know that they will be referring to this chart later. Learners might want to make extra copies of this page for a reference sheet as they work in the chapter.
4. Ask a class member to read: Why Do We Call a Foot a Foot?; Body Parts and Measurements and English and Metric Systems

of Measurement. Ask if anyone knows of any other peculiar ways that we have come to name a standardized measurement?

5. Discuss standardized measurement from the reading. Ask: What would it be like in our everyday lives if measurements were not standard?
   Ask someone to record these answers.
   Briefly discuss metric measurements and their usage. This chapter will only focus on English measurement.

6. Rulers will be needed for using the section: Measures of Length; measuring with an English ruler. If yardsticks and measuring tapes are available, they are also helpful tools of measuring for learners to become familiar with.

   a. Ask the class to take a look at their rulers. Ask them to discuss what they notice about them. They can record their answers in their workbooks.

   b. Do the same with the yardstick and measuring tape.

7. The Ruler: Either using the ruler in the workbook or their own rulers, have learners find different measurements such as the 2 inch mark and 3 and 1/2 inch mark.

8. Ask learners to look around them or in their book bags and purses to see if there are things that they can measure with their rulers or yardsticks. Learners can record their answers in the workbook. Learners can work with their math partner or in math teams.

9. Learners can also use their estimating skills to first become familiar with a measurement of length such as one inch, and then go around the room estimating their measurements. A math partner or someone in the math team can now do the accurate measurement.

10. Talk about measurement and how we can learn to "eyeball" something through experience. If we know that one child is 4 1/2 feet tall, can we guess the height of a younger child? If we know how tall we are, can we guess the height of someone else?

    Have someone who knows their height, stand next to a door and have the class estimate the height of the door frame by comparing the known persons height to the door frame. Allow them to use any means that they come up with to estimate and problem solve. As an example, they might know that if the person standing next to the door raised their arms, two feet could be added to the height of that person, making it easier to estimate the height of the door.

11. Discuss why we need to know how to convert measurements: inches to feet; feet to inches, yards, and miles; yards to miles. Discuss how they will later be able to use similar formulas to convert weight and liquid measurements.

12. Ask the class to read Converting Measurements of Length and do the practice exercises in the workbook. Have learners practice

converting height measurements and record these in their workbooks. Ask: What other measurements can be converted?

13. *About writing word problems:* If the class hasn't started to use word problems yet, now is a good time to begin, using their new knowledge of converting length measurements. Ask the class to come up with a story that uses numbers which they will convert to different measurements. The story can include members of the class. Ask someone to volunteer to record the story. Everyone else can take notes on the worksheet. Either you or a class member can type up the story for each class member or for another class. Ask different class members to lead discussions of the problems and to come up with the answers or the class can break into small groups and work on the problems as a team. The winning team can receive a certificate or some other recognition. Have teams create their own word problems.

14. Have the class read Measurement of Weight and answer the questions.

15. Have the class picture in their minds different objects and how much they might weigh. This exercise can be used for other types of measurement besides weight and is good for practicing estimation skills. Have the class discuss what objects might weigh and record their answers.

16. Have the class discuss what other things are weighed in pounds and ounces.

17. Have the class read: Converting Measurements of Weight and do the practice exercises.

18. Class members can write weight word problems and record them for future use.

19. Have class members read the entire Measurement of Liquids and answer the questions. Learners should be given time to discuss their different answers.

20. Have learners discuss what other things are weighed in ounces, cups, pints, or quarts and record their answers in their workbook. Class members can either work as math partners or teams.

21. Class members in teams or with partners can write liquid measurement word problems and record them for future use. See activity # 13.

22. Give the class copies of the beginning assessment. When the class has checked their answers, ask them to compare this assessment with their first assessment and have the class discuss any differences that they notice.

Individual Writing

23. Learners can write in their math journal about what they have learned about measurement.

Group Writing:

24. Have learners write about the following question which they discussed earlier in the lesson.

    What would it be like in our everyday lives if measurements were not standard?

Retelling the Story: Graphs and Charts

- **What Do You Know?**
- **What Are Graphs?**
- **Pictographs**
- **Circle or Pie Graphs**
- **Bar Graphs**
- **Line Graphs**
- **What Are Charts?**

Retelling the Story: Charts and Graphs

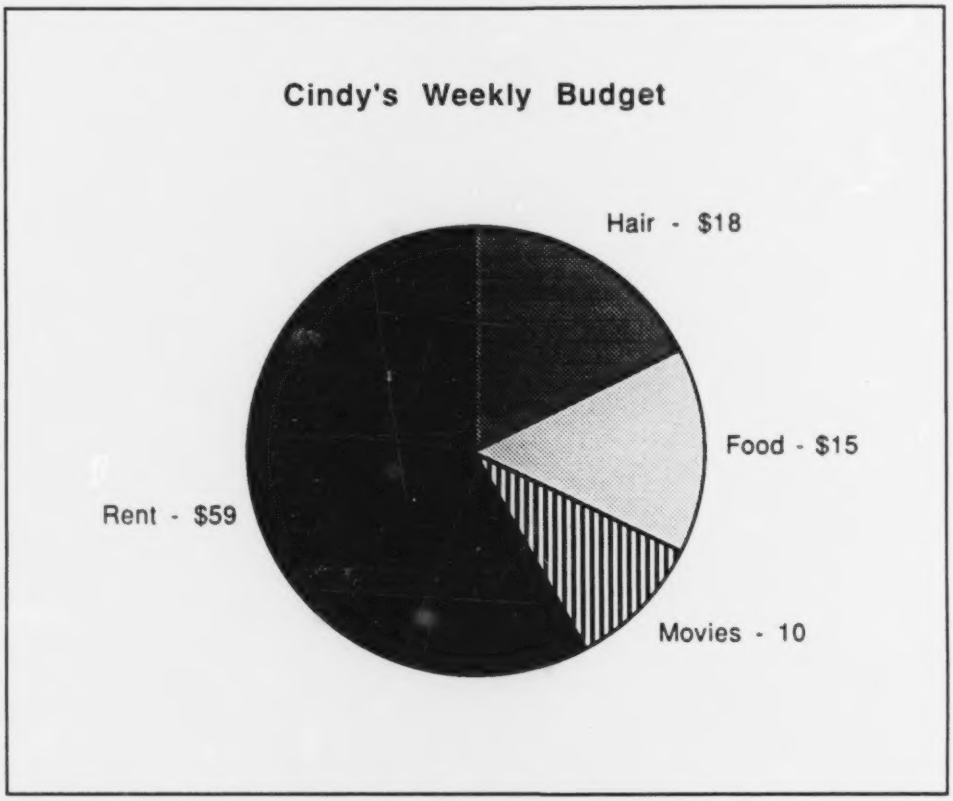
What Do You Know?

Answer the questions below. They will give you an idea of what you already know about charts and graphs. Check to see if your answers make sense.

1. Can you think of any charts that you now use? (for example: telephone bills, television listings) ________________________
   ____
2. Have you ever created a chart or graph? ____________ What was it for? ____
3. What information would you need to create a growth chart for your children or a friend's child? ________________________
   ____

- Please go to the pie graph on the next page.

Use the chart below to answer questions 4a., 4b., and 4c.



4a. How much does Cindy spend on food? ________ What does she spends on food for one year?________________________________

4b. Does Cindy spend more on her hair weekly or on her rent?________

4c. How much does Cindy budget for the entire week?________________

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What are Graphs?

Numerical data are a collection of numbers that provide specific information. Numerical data are often represented in a visual or picture form called a **graph**. A graph presents readers with a picture that makes it easier to understand and interpret data.

Activity: Reading Graphs

Note: You will need a newspaper or magazine for this activity.

Look through a newspaper or magazine and find a graph.

1. What do you notice about the graph? ______________________

   ____

2. What is the title of the graph?__________________________

3. What is the purpose of the graph?_______________________

4. What numerical information does it provide? ____________

   ____

Pictographs

One way to learn about pictographs is to create one of your own.

1. On the blackboard or on a large piece of paper, write each class member's name along the left side. You are going to make a pictograph of the number of children that each class member has. Let's call the chart "**Our Children**." (If you like, you can pick other information to chart, such as height or weight.) Now your chart has a title. It should look something like this:

OUR CHILDREN

Susan

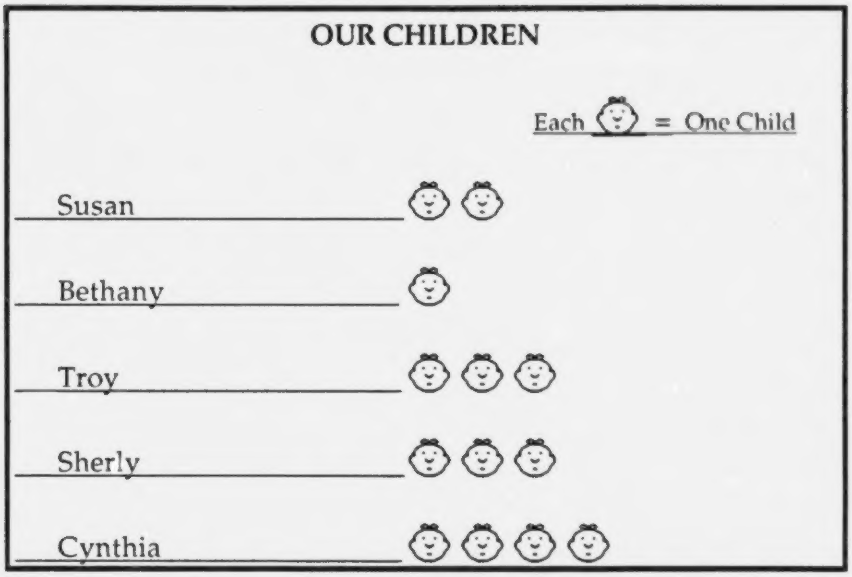
Bethany

Troy

Sherly

Cynthia

2. Now we need to fill in the information. Let's draw a picture to represent each child. Here we will use this picture ☺ to represent each child. Ask each person in the class how many children he or she has. Put the same number of pictures next to his or her name to represent the number of children. Example: Sherly–3 children: ☺ ☺ ☺. The pictograph will look something like this:



Look at the pictograph. Who has the most children?_______ _____________________________ Does Troy have more children than Cynthia?_________________________

Now look at the graph that you have created from the information from your class. Using complete sentences, write down, or summarize, the information provided about your classmates from the pictograph.

1. ____
____

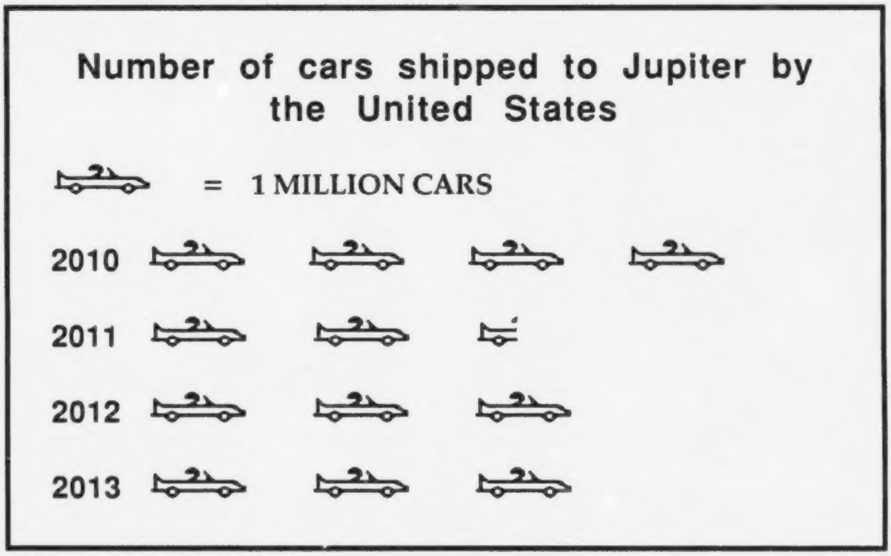
2. ____
____

3. ____
____

A **pictograph** is one type of graph. It uses symbols to represent numbers. In the above graph we used ☺ to represent one child. We could have used it to represent more than one child. Some people have many grandchildren. If we were counting grandchildren, we could have used ☺ to represent 5 grandchildren. From the information from the above graph, Susan would have had ☺ ☺, or 10, grandchildren.

Below is another imaginary **pictograph** with information about cars shipped to Jupiter. Each picture of a car represents one million cars.

Interpreting a Pictograph



Can you read the pictograph?

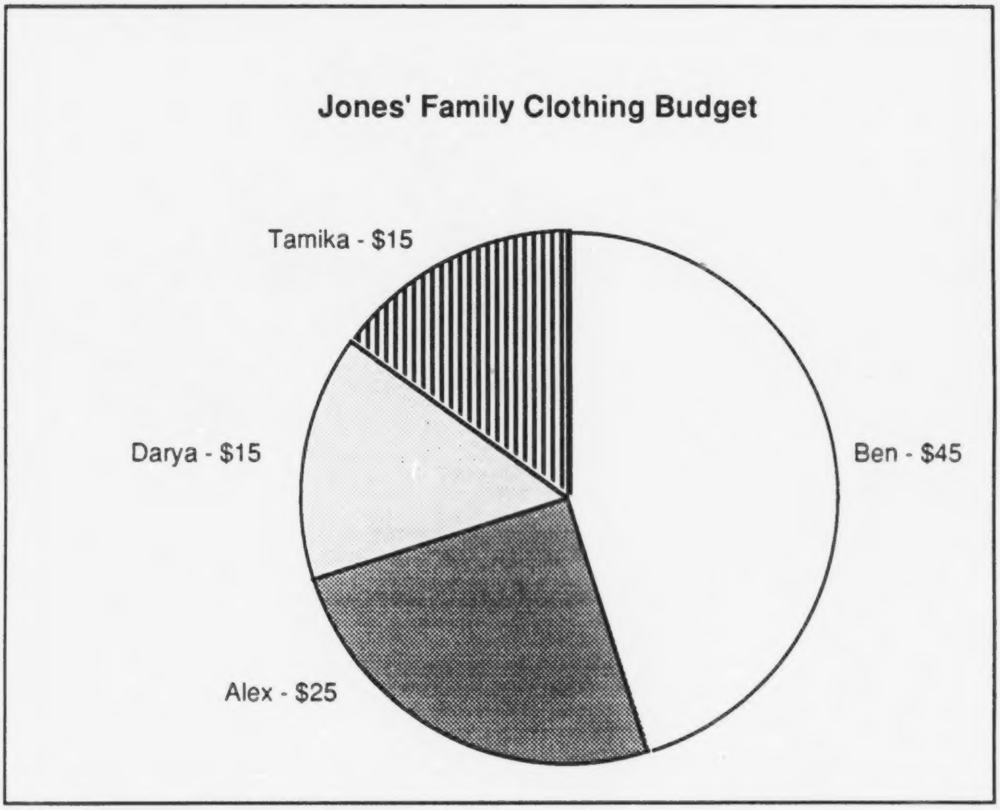
1. How many cars got shipped to Jupiter in 2010?__________________
2. Were more cars shipped to Jupiter in 2013 or 2012?________________
3. Which year were the least number of cars shipped to Jupiter?______

In 2010, there are 4 pictures of cars (🚗). Each picture represents one million cars. Four (4) million cars were shipped to Jupiter in 2010. In 2012, then there were $2\,{}^{1}/_{2}$ million cars shipped. The half of a car represents ${}^{1}/_{2}$ million, or 500,000 cars. In 2011 and 2013, there were 3 million cars shipped.

Circle or Pie Graphs

Another type of graph is called a circle or pie graph. In a pie graph, a circle is divided into pieces and each piece represents a different value. In the chart below, each piece has a dollar value. The whole circle graph is equal to the total of the budget which is $100.

- The circle or pie graph below was created by a class to show one student's clothes budget for her four children. The graph shows that she has **$25.00** for baby Alex, **$15.00** for Tamika, **$45.00** for Ben, and **$15.00** for Darya. Her total budget is **$100.00**.



Questions : Answer the questions below using the graph from the previous page.

1. How much more money is budgeted for Ben than Darya?_____

   ____

2. Will there be any money left over from the $100 budget?_____

3. Is more money being budgeted for Alex or Tamika?__________

Activity: Creating a Circle or Pie Graph

Create your own pie or circle graph using numerical information that you have collected. It can be created to reflect any numerical information that you want—for example, a monthly or weekly budgets or less important information such as how many pairs of black, brown, white, and beige shoes you own.

Step 1: Collect the information you are going to put on the graph.

Step 2: Add up the total. Example: Total number of pairs of shoes = 16 pairs.

Step 3: Separate the information into categories. Example: 3 brown pairs of shoes; 5 black pairs of shoes; 6 beige pairs of shoes; 2 white pairs of shoes. Total = 16 pairs of shoes.

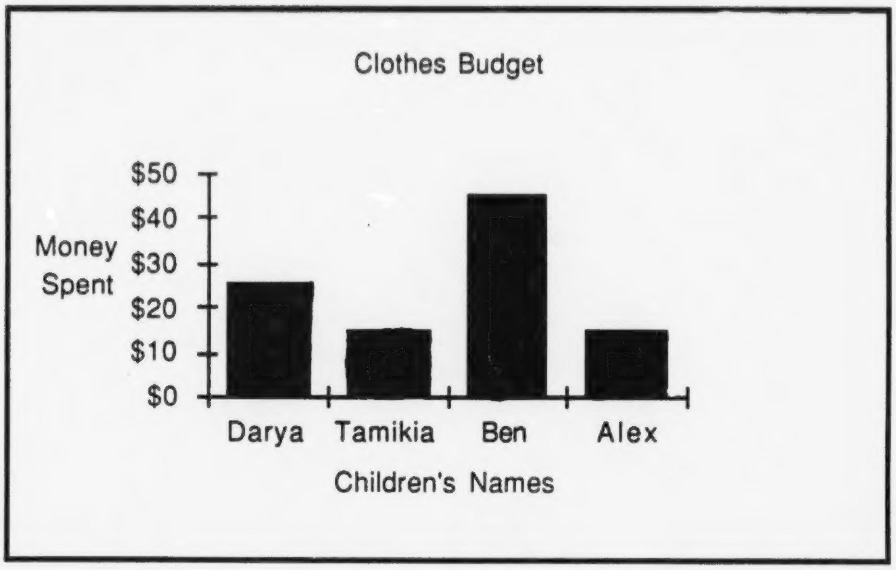
Step 4: Draw a circle—either free hand or using a pattern— and divide the circle as closely as you can to represent the different segments or "slices" of the pie chart.

If we were to chart the shoes, for example, we would need four different segments, the largest representing 6 beige pairs of shoes and the smallest "slice" representing 2 white pairs of shoes.

- When you have finished drawing your graph, work either as math teams or partners, and write about what you decided to graph and how you did it. Pretend you have to explain it to another class.

Bar Graphs

Bar graphs are graphs with bars— running either up and down or left to right—which represent numerical information. Below is a **bar graph** which uses the same numerical information about the Jones family clothes budget that we saw in the pie chart.



Questions:

1. How much does the bar graph show budgeted for Alex?____________
2. How much is budgeted for Ben?____________________________
3. Is more money being budgeted for Darya or Alex?____________
4. Is this bar graph easier or harder than the pie graph to read ?________

   Why ?____

5. Write a sentence about the information that is given in the bar graph. ______________________________

____

Activity: Creating a Bar Graph

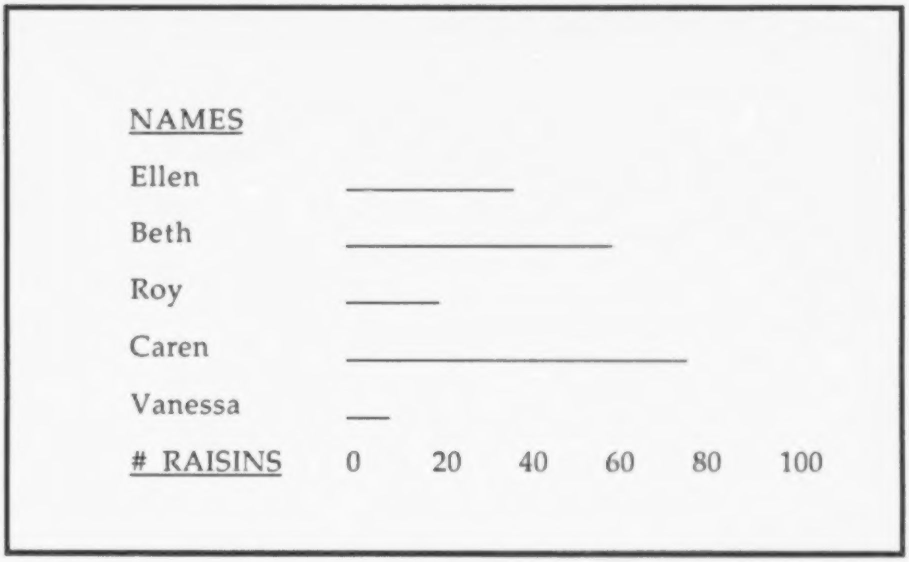
Work together as a class or in math teams to create our own bar graph.

You will need:
one snack-sized box of raisins for each class member
a volunteer to write information on the blackboard or paper

1. The volunteer at the board will be called the Chart Maker. Class members will supply the Chart Maker with the necessary information to create a bar graph.
2. The Chart Maker writes every class member's or team member's name on the board in the column on the left side and numbers along the bottom of the chart to represent numbers of raisins.

NAMES
Ellen
Beth
Roy
Caren
Vanessa
# RAISINS 0 20 40 60 80 100

3. Each class member will **estimate** or guess how many raisins are in **one** snack-size raisin box. The Chart Maker will draw a line next to each class member's name representing each person's estimate. It should look something like this:



4. The Chart Maker should thicken the lines to make bars as is seen in the Clothes Budget bar graph.

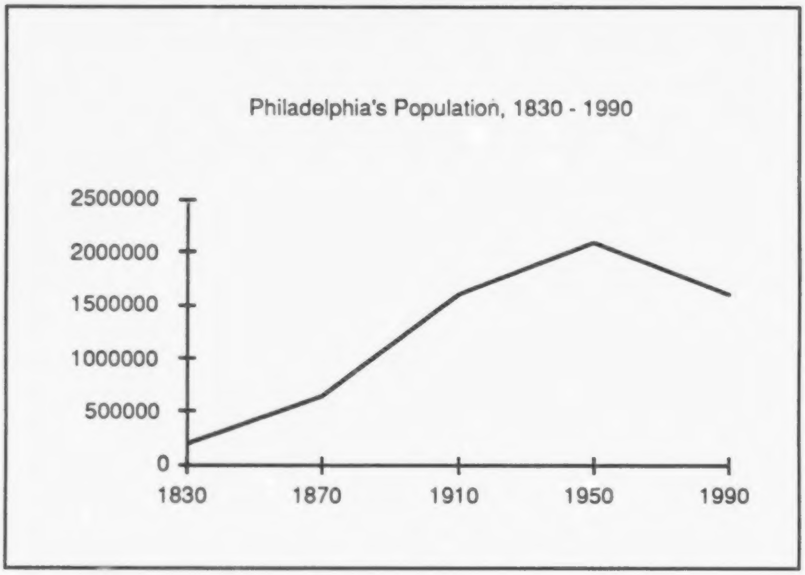
5. Someone should now count the raisins and check to see who had the estimate closest to the actual number of raisins in a box.

6. What other type of numerical information can you use to make a **bar graph**?

Line Graphs

Line graphs use one or more lines to show a trend or a change in values—for example, companies often use line graphs in quarterly financial reports to show profits and losses. Often you can find line graphs on the stock market pages of the newspaper or in a business magazine.

Below is a line graph with information about the population of Philadelphia between 1830-1990.[5] By looking at the graph, we can quickly see that the population was much lower in 1830 than in 1870 rising steadily until 1950 when it started to drop. After looking at the line graph, answer the questions that follow.



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[5] Finkel, Kenneth, Editor. *Philadelphia Almanac and Citizens' Manual,1994*. Philadelphia, PA: The Library Company. 1994.

1. From the graph, can you estimate approximately how many people lived in Philadelphia in 1870?______________________
2. In what year did the population peak?____________________
3. Can you estimate what the population in 1990 was?_________
4. From the information in the chart, and your own knowledge, do you think that the population is going to go up or down in Philadelphia in the next 40 years? Discuss your answer with other class members.

- As a class or in teams, discuss line graphs. Write down questions to ask each other.
- In a discussion, compare and contrast line graphs to pictographs, circle, and bar graphs.
- Try making a line graph by collecting data from your family such as how much sleep family members get by age. There are many things in our lives that have information that we can use to create a graph.

What are Charts?

Charts present information in columns and rows. A menu is a good example of a chart; it lists items in one column and the price in a corresponding column. To figure out the price of a specific food item, look along the row of the food item to the column with the price list. A television schedule is another example of a chart.

- **Charts, like graphs, have titles.**
- **Charts can also contain tables with words and numbers written in rows and columns. Bus and train schedules are examples of tables.**

Reading Charts

A television schedule usually looks something like this:

Morning Television Schedule

MORNING SHOWS	10:00	10:30	11:00	11:30	12:00
Monday	Kathy & Regis Talk		Cook It!	One Life	Spanish
Tuesday	Kathy & Regis Talk		Italian	How To!	Star Trek
Wednesday	Kathy & Regis Talk		Movie		

Charts have columns which are read up and down and rows which are read across, from left to right.

In this chart, the days are listed in the left column under the column heading, "Morning Shows." The remainder of the columns present the shows scheduled by the time they begin. The rows present the scheduled shows by days of the week.

The TV schedule can be read across from left to right or up and down. For example, you can read across to see all of the shows on Monday morning, or you can pick a time—say 11:30 — and see all of the shows at that time for the week.

Questions:

1. What show is on at 10:00 A.M. on Monday?_____________Is it on any other day?________________If so, when?___________________
2. When is the movie on?______________________________________
3. Wanda gets home at 11:00 each day. She watches a half hour of TV. What show does she watch on Tuesday?_______________________
4. List two shows that are on Wednesdays._______________________

   ____

- **Work with your math partner or team and list other examples of charts that you use or see in your everyday life.**

______________________________ ______________________________

______________________________ ______________________________

Activity: Creating a Chart

Class members can do this as a class or in math teams.

1. On the blackboard or posterboard, write these four column headings along a top row:

   Class Members **Sisters** **Brothers** **Birth Order**

2. List all of the class members' in the left hand column headed, "Class Members."

3. Ask the class members to write down the number of brothers and sisters they have and their own birth order in the family. **Example**: Sandy has three sisters and two brothers and she is the oldest child in the family.

4. Remember that charts have titles. Choose a title for this chart.

The chart should look something like this:

GED Morning Class • Siblings & Birth Order

Class Members	Sisters	Brothers	Birth Order
Sandy	3	2	oldest
Ron	2	6	5th born
Tricia	1	0	only child
Anthony	8	1	3rd born
Mia	0	4	youngest

- Write a short paragraph describing some of the information learned from the chart that the class or your math team has created.

- What other information could be used to create a chart?

Retelling the Story: Graphs and Charts

Lesson Plan

Goals

- To understand the parts of a chart.
- To recognize charts and look at examples of charts in everyday life.
- To learn to read pictographs, circle, bar, and line graphs.
- To understand the advantages and disadvantages of representing information in chart and graph form.
- To learn how to create graphs from numerical information.

Materials Used

- Retelling the Story: Charts and Graphs, Math Literacy.
- Paper, pencils, blackboard and chalk.
- Newspapers and/or magazines.
- Several small snack boxes of raisins.

Activities

1. Pre-Reading Discussion

To begin using the materials, ask the class to talk about what they already know about charts and graphs. The questions in the assessment, What Do You Know?, might help you to get started. Some examples of charts and graphs in our everyday lives are: utility bills, TV guides, and stock market graphs.

2. Have the class turn to the questions in What Do You Know? and ask learners in the class to read and answer the questions.

   25 - 30 minutes should be enough time for learners to read and answer the questions. Make sure that everyone has time to work through the questions at his or her own speed. Try not to give the class the impression that you are timing them, but let them know about how much time they have to will be work on the questions.

   Have the class members go over their answers using class discussion for each question. Be aware that class discussion about math feelings and anxiety can be lengthy. If you need to limit the discussion, let the class know that at the beginning.

   Ask the class to put the assessment aside for the time being and to save it for later.

Instruction:

Discuss why charts and graphs are used and how they simplify information. Ask the class to look for graphs and charts in newspapers and magazines and bring some into the class. If the class is familiar with library research, include looking up charts and graphs as part of research skills.

3. Have the class turn to What are Graphs? Ask someone to volunteer to read the first paragraph.

4. The class will need copies of the newspaper or magazines for this activity. If they would like to, the class can work as math partners or math teams at this point. Ask class members to go through the newspapers or magazines to locate graphs. If possible, the instructor could have examples of graphs already located in older newspapers or magazines in case students are unable to locate any graphs.

5. After learners have located the graphs that they will be referring to, ask them to answer the questions in the activity.

6. Have the learners read and follow the directions for Creating a Pictograph. This is a good activity for math teams. If working in teams, ask the teams to share their pictographs with each other when they have completed the activity. Learners can create a pictograph from any information that they wish. If using posterboard, the learners can display their charts in the classroom.

7. Ask the class members to share the information that they have learned about pictographs with their family and discuss what types of information the family could graph. Learners can then rely this new information back to class members.

8. Have the class read Interpreting a Pictograph "Number of cars shipped to Jupiter..." and answer the questions.

9. Ask the class to read the introductory section of Circle or Pie Graphs. Facilitate a discussion about circle graphs using the "pie" as metaphor and dividing a pie into parts to represent different values. (With some classes, food can be an added incentive to learning and real pies can be used to show value in a pie chart.)

10. Have the learners read and follow the directions for Creating a Circle or Pie Graph. As in activity 7, this is a good activity for math teams. If working in teams, ask the teams to share their pictographs with each other when they have completed the activity. Learners can create a circle graph from any information that they wish. If using posterboard, the learners can display their charts in the classroom.

11. Ask learners to read the introductory section of Bar Graphs and answer the questions. When the class reaches question #4., ask them to discuss their answers. Answers will vary. Facilitate a discussion about the information given in the bar graph before the class attempts to write a sentence for #5.

12. Ask the class members or math teams to reflect and discuss the following question: Where could bar graphs be used to make data easier to read?

13. Ask the learners to read the directions for Creating a Bar Graph. Learners will need one snack-sized box of raisins. (Caution: using other containers of small items such as toothpicks or paper clips – the amount is listed on the outside of the box.)

14. Ask someone from the class to volunteer to go to the board or to write on poster board. This person can be called the Chart Maker since they will be collecting and writing the numerical information down. Ask learners to follow the directions for creating the raisin bar graph. They will need to give their graph a name.

15. For this activity, it is suggested that class members have already covered the information in the chapter: Estimating and Rounding Numbers and are familiar with estimating. If they have already collected the raisin data from that chapter, they can use that information to create the graph.

16. Ask learners to read the introductory section of Line Graphs and to look closely at the graph to see what information they can read and if it is the same as the information in the other graphs on the clothes budget.

17. Facilitate a discussion about line graphs by asking learners to write questions that they can ask each other.

18. Ask them to compare and contrast line graphs to pictographs, circle, and bar graphs.

19. Begin a discussion with class members about charts and how they are used in daily situations. Ask the learners if they have any ideas why charts are used. (Charts help to make information clear as in a bus or train schedule. They also save space and help us compare information.)

20. Have the class brainstorm to list all the different ways that they may have used or come across charts in their lives. (Some suggestions: sports statistics, utility bills, menus, TV guides, invoices.)

21. Ask learners to begin to look for examples of charts in their lives after they leave class.

22. Have learners now read the introductory section of What Are Charts? and Reading Charts. Ask them to read the TV guide chart carefully and answer the questions.

23. Remind learners that charts are similar to graphs in that they have titles and make numerical information easier to read.

24. Ask class members to do the activity, Creating a Chart, either as a class or in math teams. Ask them to read and follow the instructions.

25. Ask learners to convert their chart information into a written paragraph describing some of the information learned from the chart that the class or the math teams have created.

26 Have the class brainstorm different information that they could use to create a chart.

Math Games

- Why Play?
- Mental M-A-T-H-O
- Roll 'Em and Weep
- The Fraction Dice Game
- FUNction Frenzy Dice Game
- The Problem Game
- The Case of the Disappearing Digits
- 21, Oh No!
- Math Mystery

Math Games

Why Play?

You may ask yourself or members of your math team, "Why play math games?" If you had to explain this to another class or other learners, what are some of the reasons that you can think of? Some learners found that playing math games aided them in understanding some mathematical concepts and helped them learn computations that they were unfamiliar with. Write your reasons in complete sentences.

MENTAL MATHO

Materials needed:	**MATHO Card; Caller's Sheet a watch with a second hand.**
Number of Players:	**2 or more; 1 caller.**
Time:	**5 seconds per problem or class choice of time limit.**

- MATHO is a game similar to BINGO.

Object: To develop mental computation skills and active listening skills.

How to make Caller Sheets and MATHO Game Cards:

1. Players will first create Caller Sheets and MATHO Game Cards.
2. Each player gets a blank MATHO Caller Sheet and records 24 problems with their correct solutions, one on each blank line. (Line 3 under letter "T" is a free space.) The problem can involve addition, subtraction, multiplication, and/or division depending on the players' skill levels. This should be decided by the class.
3. Next, each player gets a blank MATHO Game Card and copies the answers to the problems on the Caller Sheet to the boxes in the corresponding columns on the Game Card. However, the answers are not copied in the order 1- 5 in which they appear on the Caller Sheet. For example:

Caller Sheet	Game Card
M	M
1. 2 + 3 = 5	16
2. 7 + 9 = 16	1
3. 0 + 1 = 1	23
4. 23 + 2 = 25	5
5. 17 + 6 = 23	25

The Caller Sheet and Game Cards are collected and photocopied for future use.

Rules of the Game:

1. To play MATHO, one set (Caller Sheet and Game Card) are selected and copies of the card are made for each player.

2. The Caller calls out a new math combination and row every 5 seconds by calling out a row, such as **"M"** and the problem from that row, such as **"2 + 3."** Beginning math learners can decide to have the caller extend this time limit. The Caller must check off what has been called. **The Caller reads only the problem, not the answer.**

3. Players cannot write the combinations down on their paper but must listen for the problem and do Mental Math!

4. Players cannot ask for a repeat of a combination just as in a regular BINGO Game.

5. Every combination is equal to a number on the player's MATHO Game Card. As a combination such as 12 + 13 is called out, the player looks for the answer - 25 - on the card and marks the 25 square.

How To Win:

1. Players can win, as in regular BINGO, by filling a row or column, vertically, horizontally, diagonally, or by getting all four corners. Some of the more experienced BINGO players can share their BINGO scoring knowledge with other players.

2. When a player (or players) has a winning combination, he or she yells MATHO! The Caller checks the player's card for accuracy. If the player has MATHO, he or she is the winner and a new game begins; otherwise, play continues.

3. **Round-Robin** is another way to score MATHO by going all the way around the edge of the card.

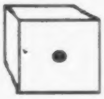
MATHO CALLER SHEET

CALLER SHEET

M	A	T	H	O
1. ________	1. ________	1. ________	1.________	1. ________
2. ________	2. ________	2. ________	2.________	2. ________
3. ________	3. ________	3 FREE	3.________	3. ________
4. ________	4. ________	4. ________	4.________	4. ________
5. ________	5. ________	5. ________	5.________	5. ________

MATHO GAME CARD

M	A	T	H	O
		FREE		

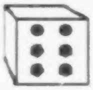
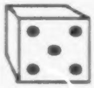
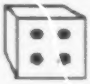
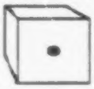
Roll 'Em and Weep 

Materials needed: **Dice, paper and pencil for score keeping.**
Number of Players: **2 or more.**
Time: **No limit.**

Object: To be the first player to roll the dice and get to 50 by adding or subtracting.

1. Two or more players can play. One class believes that the game plays best with four players. Play with 2 dice.
   - No touching someone else's dice.
   - If you roll out of turn you lose your roll.
   - Decide on which player will keep score.
   - Start over after someone wins. The winner keeps score for the next round.

2. Each player takes a turn and rolls the dice and decides whether to add or subtract the numbers rolled.

   Example: Player number one rolls  and , decides to add and gets the score 11. The next player might roll  and , add and get 5.

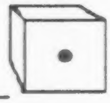
3. As you get near to 50, you will need to subtract to help you reach exactly 50. Look at the examples below:

Two ways to subtract: Example

a. Roll a six and a three, say 6-3=3 and then subtract 3 from your current total score **or**

b. Add the two dice together and subtract that number from your score. 6 + 3 = 9 Subtract 9 from your current total score.

The Fraction Dice Game



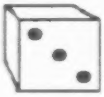
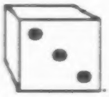
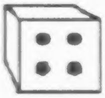
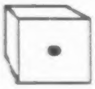
Adding and Subtracting Fractions

Materials needed:	**Dice, paper and pencil for score keeping. Cover the sides marked 5 and 6 on the dice. Play with just the numbers 1, 2, 3, and 4. (You can play with numbers 1 through 6 but the game takes a very long time.)**
Number of Players:	**2 and up.**
Time:	**No limit.**

Object: **To be the first player to get to a score of 5 by creating and either adding or subtracting fractions.**

1. Two or more players can play. Play with 2 dice.
   - No touching someone else's die.
   - If you roll out of turn you lose your roll.
   - Each player keeps his or her own score.
   - Start over after someone wins.

2. Each player takes a turn and rolls the dice.

   Example: Player number one rolls  and . Player number one has $^{3}/_{3}$ or 1. The next player rolls  and  and will either have a score of $^{1}/_{4}$ or $^{4}/_{1}$ (4). Each player decides what his or her fraction will be on each roll.

3. As you get closer to 5, you can start to subtract to help you reach exactly 5. Look at the examples below:

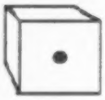
Player 1				Player 2			
Roll	Number	Operation	Total	Roll	Number	Operation	Total
3,3	$^{3}/_{3}$		1	4,1	$^{4}/_{1}$		4
1,3	$^{3}/_{1}$	+	4	2,4	$^{2}/_{4}$	+	$4\,^{2}/_{4}$
3,4	$^{3}/_{4}$	+	$4\,^{3}/_{4}$	1,3	$^{1}/_{3}$	+	$4\,^{10}/_{12}$
2,4	$^{2}/_{4}$	-	$4\,^{1}/_{4}$	4,4	$^{4}/_{4}$	-	$3\,^{10}/_{12}$

Notice that in roll #3, player 2 had to change fourths and thirds to the common denominator of twelfths. Also, in roll #4, both players had to subtract to keep from going over 5.

4. The game is over when one player gets **exactly** 5.

Make up new rules as you come across them!

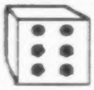
FUNction Frenzy Dice Game



Adding, Subtracting, and Multiplying Whole Numbers

Materials needed:	**Die, paper and pencil for score keeping.**
Number of Players:	**2 and up.**
Time:	**No limit.**

Object: To be the first player to get to 50 by adding, subtracting or multiplying the number on the die. If you go over 50, you're out!



1. Two or more players can play. Play with 1 die.
   - No touching someone else's die.
   - If you roll out of turn you lose your roll.
   - Each player keeps his or her own score.
   - Start over after someone wins.

2. Players take turns and roll the die. **Before rolling,** the player announces whether he will add, subtract or multiply his roll with his total.

   Example: Player number one rolls ⚅ so that is his score. Player two might roll ⚃. Player one says he will multiply his roll by his total. He rolls ⚄ so his score is 30. Player two announces he will add his roll and also rolls ⚄ so his total is 9.

3. Players have to be careful to try to get 50 without going over. As they get close to 50, they need to think of the odds of getting the number they need on the next role as opposed to the odds of going over 50. For example, if a player has 44, there is one chance in six of getting the needed number, 6, to make 50. There is no chance of getting more than 6 (a die is numbered 1 through 6) so the player should definitely add. However, if the player has 48, there is still only one chance of getting exactly 50 (roll a 2), but four chances of going over (roll a 3, 4, 5, or 6). Only a real gambler would add in this situation.

Complete the table below. Figure out the possibilities of adding a number rolled on one die to a starting total of 44, 45, 46, 47, 48 and 49.

Starting Total	Possibilities for getting 50	Possibilities for staying under 50	Possibilities for going over 50
44	1 (roll a 6)	5 (roll a 1, 2, 3, 4, 5)	0
45	1 (roll a ____)	4 (roll __________)	1 (roll a __________)
46	1 (roll a ____)	___ (roll a __________)	___ (roll a __________)
47	1 (roll a ____)	___ (roll a __________)	___ (roll a __________)
48	1 (roll a 2)	1 (roll a 1)	4 (roll a 3, 4, 5, 6)
49	1 (roll a ____)	___ (roll a __________)	___ (roll a __________)

4. The game is over when one player gets **exactly** 50 or when only one player is left.

Make up new rules as you come across them!

The Problem Game

Materials needed: **Blackboard, chalk.**
Number of Players: **4—6 per team.**
Time: **Beginning level— no time limit; Advanced teams can set their own time.**

This game helps learners work in teams as they create their own problems.

Object: Teams try to out fox each other by creating tough problems but ones which are not too difficult for their own team to answer correctly. The first team to answer all of their questions correctly wins!

- Some guidelines need to be agreed upon before the beginning of the game, such as limiting the number of digits in each problem or the math function for the level of the teams.

  Example: Both teams will agree to use numbers with place values no greater than to the hundredths place and only in addition or subtraction. **34.73 + 812.02 = ?**

  This prevents one team that is better in decimals from having an unfair advantage. These guidelines are to be established before each game.

How To Play:

1. The class divides into teams and picks a team name. Someone must volunteer to be the scorekeeper. The scorekeeper cannot play while keeping score.

2. Together the team writes one problem for each member of the opposite team. Each problem is written on a separate piece of paper and numbered starting with 1. The answers to the problems are written on a numbered answer sheet.

   Example:

   If there are 6 team members, Team Applesauce must write 6 different problems on six separate pieces of paper numbered 1 – 6. They number their answer sheet from 1 to 6 and write the answer for each problem beside the appropriate number.

3. The scorekeeper collects the problems and answer sheets, keeping each team from seeing the other team's work. The scorekeeper then uses **Team A**'s problems for **Team B** and **Team B**'s problems for **Team A**.

4. The blackboard is divided in half. As each team member goes to the board in rounds, the scorekeeper gives each one a problem. They put the problem on the board and compute the problem.

Scoring:

5. Team members must solve their problems without help from the rest of the team. Let's say that the first person done is on **Team B**. If the

problem was solved correctly, **Team B** wins **three points**. If **Team A** had the incorrect answer on their answer sheet, **Team B** gets another point. If the **Team B** member gets the problem wrong and **Team A** had the correct answer on their answer sheet, **Team A** gets one point and **Team B** gets none. The Scorekeeper must be able to keep track of this and check answers. Use of a calculator or help from the instructor is acceptable.

6. The team with the most points at the end of the game wins!

THE CASE OF THE DISAPPEARING DIGITS

Materials needed: **Digit Sheets.**
Number of Players: **Any number.**
Time: **Varies, no limit.**

Object: This game can help learners understand the importance of place value and setting up problems. It can also be used with family members.

Rules of the Game:

The rules are simple. Use the attached **missing digit sheet** as an example, but feel free to make up your own! The example is for addition and subtraction but be creative and use your math knowledge to challenge your team when you create a missing digit sheet.

1. Look at the attached sheet. All players should have the same sheet with the same problems.
2. The players need to establish a time limit based on the difficulty of the **missing digit sheet.**
3. A scorekeeper needs to keep track of the time limit and let players know when time is up.
4. Players exchange missing digit sheets and check each other's answers. The player who has finished the most correct answers is the winner.

Disappearing Digits Worksheet

$$\begin{array}{r} 719 \\ -\ 3?4 \\ \hline 335 \end{array}$$

$$\begin{array}{r} 2?0 \\ -65 \\ \hline 155 \end{array}$$

$$\begin{array}{r} 329 \\ -\ 17? \\ \hline 156 \end{array}$$

$$\begin{array}{r} 2?0 \\ -104 \\ \hline 136 \end{array}$$

$$\begin{array}{r} ?21 \\ +214 \\ \hline 335 \end{array}$$

$$\begin{array}{r} 6{,}7?9 \\ -\ 3{,}297 \\ \hline 3{,}452 \end{array}$$

$$\begin{array}{r} 329 \\ -\ 27? \\ \hline 56 \end{array}$$

$$\begin{array}{r} 2?2 \\ -104 \\ \hline 138 \end{array}$$

$$\begin{array}{r} 823 \\ -\ 2?8 \\ \hline 535 \end{array}$$

$$\begin{array}{r} 2?4 \\ -89 \\ \hline 155 \end{array}$$

$$\begin{array}{r} 329 \\ -\ 28? \\ \hline 43 \end{array}$$

$$\begin{array}{r} 3?2 \\ +104 \\ \hline 496 \end{array}$$

$$\begin{array}{r} 477 \\ -??? \\ \hline 239 \end{array}$$

$$\begin{array}{r} ??? \\ -165 \\ \hline 137 \end{array}$$

$$\begin{array}{r} 5?6 \\ -?2? \\ \hline 248 \end{array}$$

$$\begin{array}{r} 2?0 \\ +?89 \\ \hline 57? \end{array}$$

21 *Oh No*

Materials needed:	**None**
Number of Players:	**2 or more.**
Time:	**Varies, no limit.**

Object: This is a counting game for two players. Try to outsmart your opponent! Each player tries to be the first to reach the count of 21.

How To Play:

1. Players must decide who will go first.
2. During each turn, each player can either count one number or two numbers.

Example 1:		**Example 2:**		**Example 3:**	
Player # 1:	1	Player # 1:	1, 2	Player # 1:	1
Player # 2:	2	Player # 2:	3	Player # 2:	2, 3
Player # 1:	3	Player # 1:	4	Player # 1:	4, 5
Player # 2:	4	Player # 2:	5, 6	Player # 2:	6, 7

TIP 1: Notice when you can tell who is going to get to say 21. Once you can tell, consider this a key number. Now notice when you can tell who is going to get to say that key number. Consider this your new key number and continue working backwards. It might help to write down the key numbers and see what they have in common.

TIP 2: Think of who should go first.

Math Mystery

Materials needed: None.
Number of Players: 2 or more.
Time: Varies, no limit.

Object: This is a guessing game similar to other games you may have played. The main difference is that all clues involve numbers.

How to Play:

1. One player selects an item. He tells the other players whether it is animal, vegetable, or mineral. A discussion of what belongs to each group might avoid later confusion or disagreement. For example, it is important to note that for this game, humans are considered animals.

2. The other players take turns asking questions about the item. Each question must involve a number. Also, answers can only be "yes" or "no." For example, if the first player says "I'm thinking of something that is an animal," questioning might proceed as follows:

Does it have 4 legs?	No
Does it have 2 legs?	Yes
Is its temperature about 98.6^{0}?	Yes
Was it born before 1950?	Yes
Does it have 2 X chromosomes?	No

Note that every question has a number in it. Questions which do not have a number in them cannot be answered.

3. Play continues until someone guesses the item correctly. If a player attempts a guess and is incorrect, he or she is out.
4. The player who guesses correctly gets to choose the next item.

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